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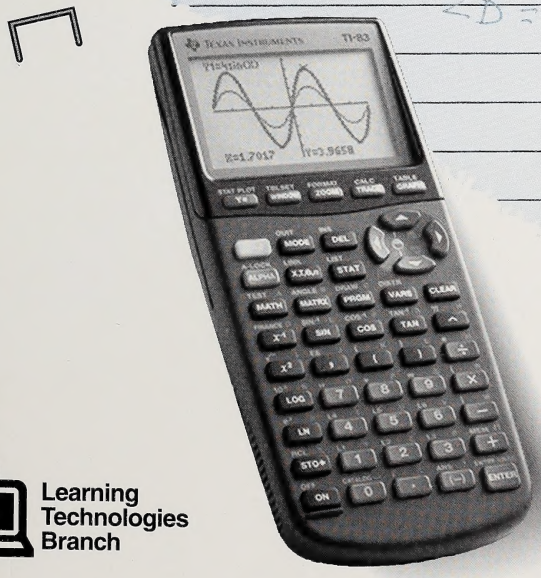
Module 1

MATHEMATICS 10

Statistics and Data Tables



Learning Technologies Branch

Alberta LEARNING

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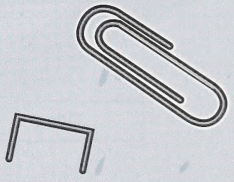
Pure MATHEMATICS 10

Module 1
Statistics and Data Tables



Learning Technologies Branch

Alberta LEARNING

Pure Mathematics 10
Module 1: Statistics and Data Tables
Student Module Booklet
Learning Technologies Branch
ISBN 0-7741-2135-1

This document is intended for	
Students	✓
Teachers	✓
Administrators	
Home Instructors	
General Public	
Other	

You may find the following Internet sites useful:

- Alberta Learning, **http://www.learning.gov.ab.ca**
- Learning Technologies Branch, **http://www.learning.gov.ab.ca/ltb**
- Learning Resources Centre, **http://www.lrc.learning.gov.ab.ca**

The use of the Internet is optional. Exploring the electronic information superhighway can be educational and entertaining. However, be aware that these computer networks are not censored. Students may unintentionally or purposely find articles on the Internet that may be offensive or inappropriate. As well, the sources of information are not always cited and the content may not be accurate. Therefore, students may wish to confirm facts with a second source.

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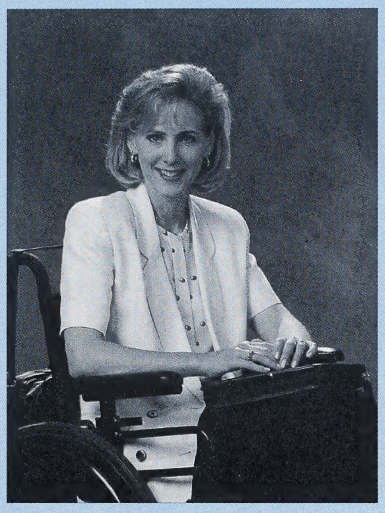
Welcome



Welcome to Module 1. We hope you'll enjoy your study of Statistics and Data Tables.

Pure Mathematics 10

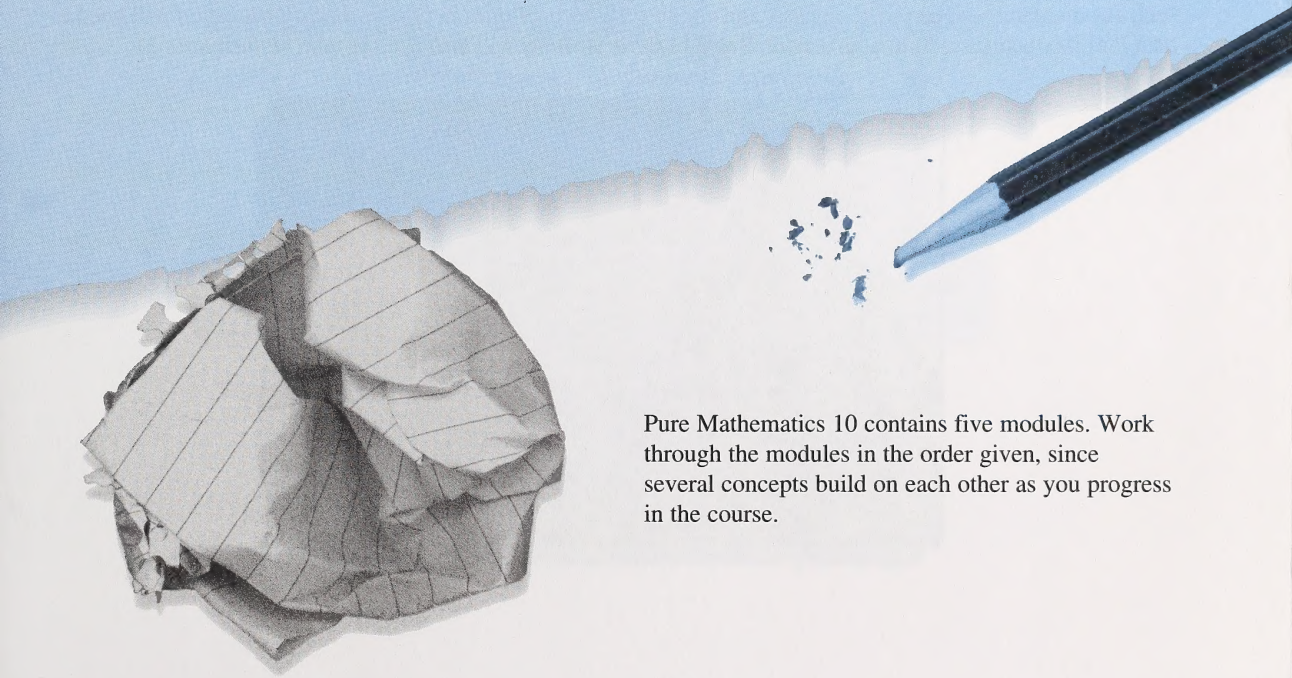
Module 1
Statistics and Data Tables

Module 2
Patterns and Relations

Module 3
Algebra

Module 4
Number Connections

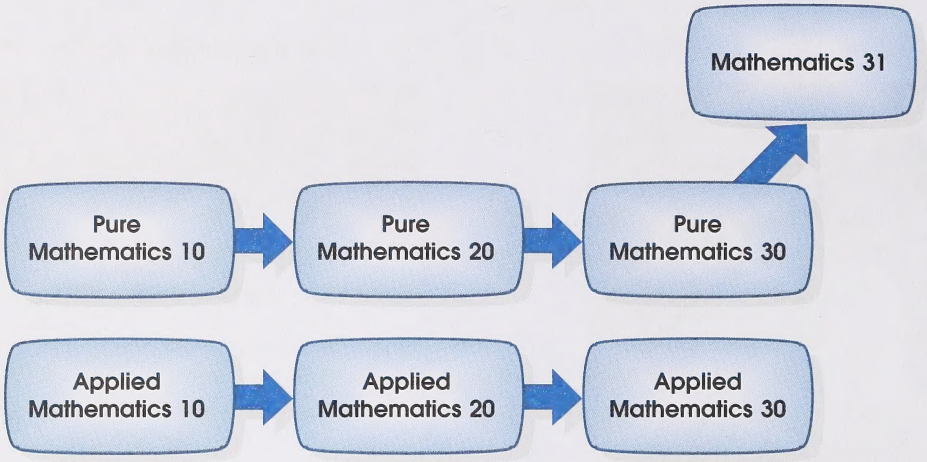
Module 5
Trigonometry



Pure Mathematics 10 contains five modules. Work through the modules in the order given, since several concepts build on each other as you progress in the course.

High School Mathematics Courses

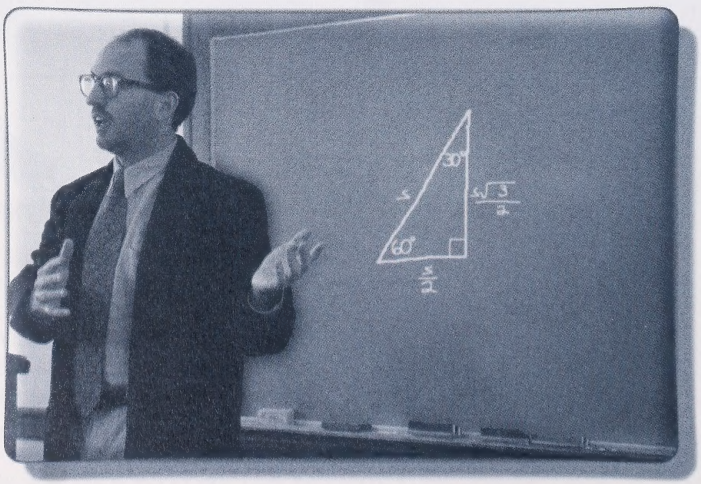
Pure Mathematics 10 is the first course in the Pure Mathematics 10–20–30 sequence of courses. Many students who take the Pure Mathematics 10–20–30 will also choose to take Mathematics 31. Another sequence of courses is Applied Mathematics 10–20–30.



How Do the Sequences Differ?

Each sequence of courses is designed for students with different mathematical strengths and interests. The Pure Mathematics 10–20–30 sequence is intended for students who are strong in mathematical theory and algebra. The Applied Mathematics 10–20–30 sequence is better suited to students who prefer to solve mathematical problems using numerical reasoning or geometry.

Each sequence of courses is designed for students with different career plans. Students who plan to take courses such as commerce, engineering, physics, and engineering technologies in post-secondary education will need to take Pure Mathematics 30 in high school. Some of these students will also need to take Mathematics 31.

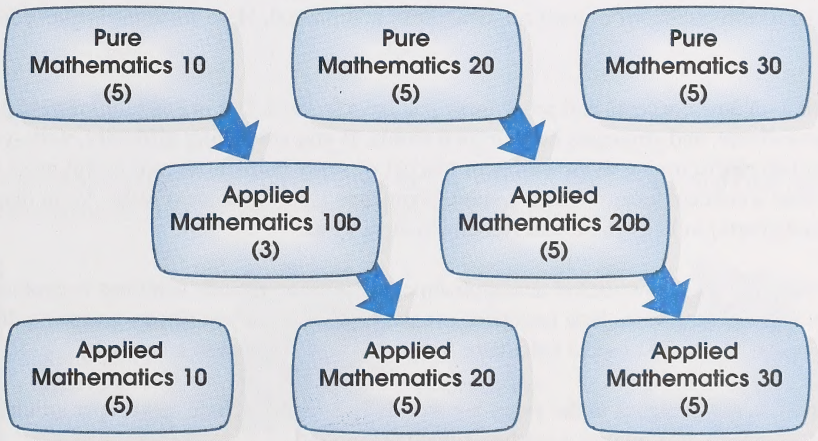


Can I Transfer to the Applied Mathematics Sequence of Courses?

You should be aware that the applied and pure mathematics courses do have some topics in common; other topics are independent.

Applied Topics	Common Topics	Pure Topics
• linear programming • data tables and trends • design and layout • metric and imperial measure • data presentation • vectors and matrices • periodic, fractal, and recursive patterns • financial decision making • costing and design problems	• spreadsheets • line segments and linear graphs • scaling • triangles • surveys • financial mathematics • quadratic functions • circle geometry • the bell curve	• irrational numbers • exponents • polynomial and rational expressions • mathematical expectation • growth patterns • linear and non-linear systems • operations on functions • mathematical reasoning • exponential and logarithmic functions • conics • combinations • trigonometric functions

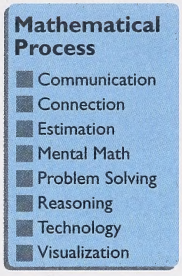
If you want to transfer from the Pure Mathematics 10–20–30 sequence to the Applied Mathematics 10–20–30 sequence at a future time, you won't have to repeat the topics that are common to pure mathematics and applied mathematics. If you decide to transfer to the Applied Mathematics sequence of courses after successfully completing Pure Mathematics 10, you may take the 3-credit course called Applied Mathematics 10b or you may take the 5-credit course called Applied Mathematics 10. If you decide to transfer after successfully completing Pure Mathematics 20, you will take the 5-credit course called Applied Mathematics 20b. The two bridging courses are shown in the following diagram:


Pure Mathematics 10 (5)
Pure Mathematics 20 (5)
Pure Mathematics 30 (5)
Applied Mathematics 10b (3)
Applied Mathematics 20b (5)
Applied Mathematics 10 (5)
Applied Mathematics 20 (5)
Applied Mathematics 30 (5)

Mathematical Processes

Throughout the course you will be expected to do the following:

- communicate mathematically
- connect mathematical ideas to everyday experiences and to concepts in other disciplines
- develop and use estimation strategies
- develop and use mental math strategies
- develop and use problem-solving strategies
- reason and justify your thinking
- select and use appropriate technologies as tools to solve problems
- use visualization to assist in processing information, making connections, and solving problems



This icon shows which mathematical process you are expected to perform.

In order to develop these mathematical processes more fully, you are encouraged to ask someone who is also taking Pure Mathematics 10 to be your study partner. You will find that having a friend to discuss mathematics with will make your studying more enjoyable.

You are also encouraged to record your mathematical ideas in a journal. Here are some suggestions for organizing your journal:

- Keep a section on new concepts and procedures you have learned. Get in the habit of describing new concepts, procedures, and strategies in your own words. If you are having difficulty, write your questions in your journal before discussing them with your teacher or study partner. Record useful ways to help you remember what a concept means. Make graphic organizers (such as context webs, Venn diagrams, or organizational charts) to help you connect mathematical ideas.

- Keep a section on your mathematical accomplishments. This can include solutions to problems that you are proud of solving. It can also include landmark events, such as when you finally grasped a difficult concept (an "aha!") or when you first used a calculator or spreadsheet program in a new way.

- Keep a section on mathematics in the everyday world. This could include newspaper articles, cartoons, and descriptions of careers that require a mathematical background.

Resources You Will Need

In order to complete Pure Mathematics 10 successfully, you will need to have access to the following resources, which can be purchased through the Learning Resources Centre:

- the *MATHPOWER™ 10* textbook and data disks, Western Edition, published by McGraw-Hill Ryerson (1998)

- a graphing calculator
  Any of the following graphing calculators may be used: *Texas Instruments* TI-83, TI-83 Plus, TI-86, TI-89, TI-92, or TI-92 Plus; *Casio* Algebra FX-2.0, CFX-9850 GA-Plus, CFX-9850 G, CFX-9800 G, or FX-9700 series; *Sharp* EL-9600C, EL-9600, EL-9200, or EL-9300; or *Hewlett-Packard* HP 39g (only approved for 2001–2003 school years). **Note:** Some calculators are no longer commercially manufactured.

- spreadsheet program
  Any of the following spreadsheet programs may be used: *ClarisWorks™ 4.0* (or higher) for Macintosh or for Windows, *Microsoft® Access 97* and *Microsoft® Excel 97* for Windows (a part of *Microsoft® Office Professional 95* or *Microsoft® Office Professional 97*).

Note: Examples in this course show the TI-83 graphing calculator and the *ClarisWorks™ 4.0* spreadsheet program where applicable. The screen shots in this module have been reprinted by permission from Apple Computer, Inc.

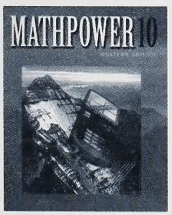
You will need access to a computer (mandatory) and a videocassette player (optional).

Finally, you will need the following resources, which can be purchased locally:

- a mathematical instrument set (compass, protractor, ruler, and triangles)
- a binder in which to respond to the questions asked
- a binder for journal writing

Other Visual Cues

In addition to the Mathematical Process icon described earlier, you will find other visual cues throughout this course. Read the explanations given to discover what each icon prompts you to do.



Refer to the textbook.

View a videocassette.

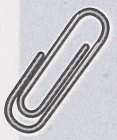
Use the Internet to explore a topic.

Answer the questions in the Assignment Booklet.

Use the Computer Data Bank.

Remember: *Any Internet website address given in this module is subject to change.*

CONTENTS



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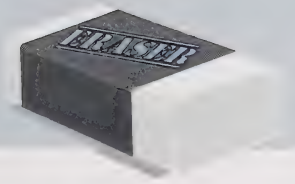


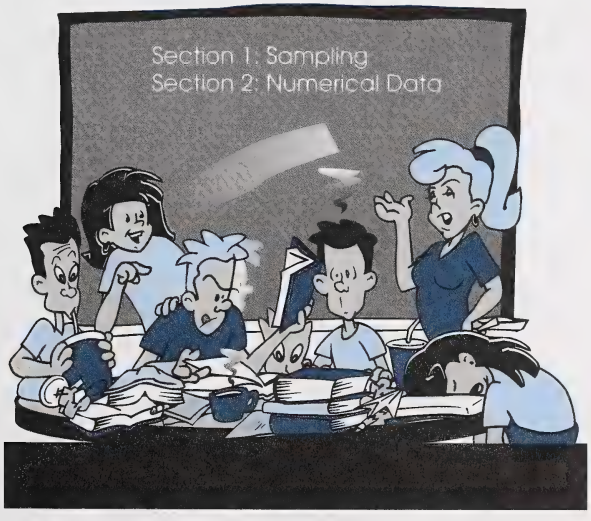
Module Overview

Being able to work effectively with others is increasingly more valued by society. No one individual can be an expert in all areas. People must share expertise and explore different points of view in order to solve problems and make critical decisions.

The students in the graphic organizer are working on a school project that involves collecting information using a survey, analysing the information, and presenting their results. Sorting through data is a difficult process. How could they work more effectively? Could they use technology to assist them in their task? What is the probability that their report will be an accurate reflection of the information they have collected? Will their conclusions be valid? Will their conclusions be communicated in a meaningful way to others?

In this module, you will gather and analyse information, make decisions, and assess their validity. In Section 1, you will investigate how surveys are conducted. You will judge the accuracy of the information gathered and draw conclusions based on this information. In Section 2, you will sort through information and summarize your efforts using tables, using computer spreadsheets and databases to assist you.You will then look for trends in the information gathered and draw conclusions.

Module 1:
Statistics and Data Tables



Evaluation

The document you are presently reading is called a Student Module Booklet. It will show you, step by step, what to do and how to do it.

This module, Statistics and Data Tables, has two sections. Within each section, your work is grouped into activities. Within the activities, there are readings and questions for you to answer. By completing these questions you will construct your own learning, discover mathematical connections, and practise or apply what you have learned. The suggested answers in the Appendix of this Student Module Booklet will provide you with immediate feedback on your progress.

In this module, you will be directed to the accompanying Assignment Booklets. You are expected to complete two Assignment Booklets for this module. Your grading in this module is based in part upon the assignments you submit for evaluation. The mark distribution is as follows:

Assignment Booklet 1A	
Section 1 Assignment	**30 marks**
Assignment Booklet 1B	
Section 2 Assignment	**30 marks**
Final Module Assignment	**40 marks**
TOTAL	**100 marks**

Strategies for Completing a Module

Before you begin, organize your materials, Student Module Booklet, textbook, Assignment Booklet, binder, lined paper, graph paper, graphing calculator, pens, pencils, and so on. Make sure you have a quiet area in which to work, away from distractions. Set up your time schedule.

To achieve success in this module, be sure to read all your instructions carefully and work slowly and systematically through the material. Remember, it's the work you do in this Student Module Booklet that will prepare you for your assignments and final test. Try to set realistic goals for yourself each day; and once you've set them, stick to them. Submit your assignments regularly, and don't forget to review your work before handing it in. Careful work habits will greatly increase your chances for success in Pure Mathematics 10.

Good luck!

Section 1

Sampling

What will the crops be like this year? The answer to this question is not of interest only to individual farmers looking at their fields. The nation's economy is affected by the success or failure of the harvest. Farm implement and equipment dealers, businesses servicing the agricultural sector, the railways, truckers, investors, and governments and their agencies make decisions that rely on the accuracy of crop forecasts.

How representative is the field in the photograph? How much information is available from farms across the countryside? How is it collected and analysed? These questions are important considerations when assessing the reliability of every prediction.

In this section, you will investigate sampling techniques in statistics. You will determine how appropriate those information-gathering methods are and how reliable and representative the information obtained is. You will also defend or criticize generalizations drawn, based on the information collected.

Activity 1: Sampling Techniques

Have you ever gone camping in the summer and listened, in the quiet of the evening, to the cry of a loon? The call of a loon on a northern lake is one of many symbols of the Canadian wilderness. Recently, scientists from Environment Canada have been concerned about the concentration of mercury in the loons of Eastern Canada. High levels of mercury in the blood affect the birds' ability to reproduce. These concerns extend to human health because, like loons, humans are at the top of the food chain.

Since testing the blood of all loons is impossible, how was the information about the loons gathered? How many were tested, and where? How representative was this sample of the entire loon population in Eastern Canada?

Questions like these are the domain of **statistics**—the branch of mathematics that deals with planning experiments to gather information, the analysis and presentation of that information, and making decisions based on the information gathered. The word *statistics* comes from the Latin word *status*, which means "condition," "standing," or "state." The early history of statistics can be traced to the Roman **census**, taken to gather information on the state of the Empire. A census in statistics means the process of collecting information from all the elements or individuals in a **population**. It may not always be possible, practical, or economical to conduct a **survey** of an entire population. Instead, a subset of the population, or **sample**, is surveyed.

In the example of the loons, the population consists of all the loons in Eastern Canada. The birds from which blood samples were taken and analysed constitute the sample surveyed.

Turn to page 364 of *MATHPOWER™ 10* and read "Sampling Techniques."

1. Answer the following questions on page 364 of the textbook. If you cannot work in a group or with a partner, reflect on what you feel the answers should be.

a. questions a. to c. of "Explore: Make Predictions"
b. questions 1 and 2 of "Inquire"

Compare your responses with those in the Appendix, Section 1: Activity 1.

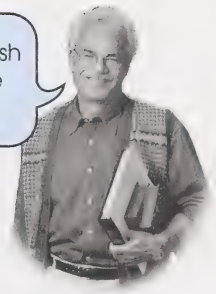
Mathematical Process

- Communication
- [X] Connection
- Estimation
- Mental Math
- Problem Solving
- Reasoning
- Technology
- Visualization

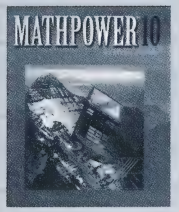
census: the process of collecting information from all the individuals or elements of a population

survey: the process by which information is collected from a sample

sample: a part or subset of a population



Being able to identify the population that you wish to question will help you choose representative samples to survey.



Turn to page 364 of *MATHPOWER™ 10* and read from the red line to the red line on page 365, working through Example 1.

2. Answer questions 1 to 5 of "Practice" on page 368 of the textbook.

Compare your responses with those in the Appendix, Section 1: Activity 1.

---

probability sampling: the selection of a sample from a population that involves the random selection of elements

non-probability sampling: the selection of a sample from a population that does not involve the random selection of elements

There are numerous techniques for selecting samples from a population. Those techniques can be placed in two general categories: **probability sampling** and **non-probability sampling**. Probability sampling involves random selections from the population. You will now look at examples of sampling techniques from both categories.

Turn to pages 365 to 367 of *MATHPOWER™ 10* and work through Examples 2 to 6.

3. Answer the following questions on page 368 of the textbook:

a. questions 7 and 8 of "Practice"
b. questions 11 and 12 of "Practice"
c. questions 13 and 14 of "Practice"

Compare your responses with those in the Appendix, Section 1: Activity 1.

Mathematical Process
- Communication
- Connection
- Estimation
- Mental Math
- [X] Problem Solving
- Reasoning
- Technology
- Visualization

Example

You are on the students' council of a high school of 200 students. The administration has suggested a nine-period rotating timetable. The students' council has asked you to conduct a survey. You decide to question 50 students on the proposed timetable change. Describe three probability sampling techniques you could use to select your sample.

Solution

You could use **simple random sampling**. In simple random sampling, every member of the population has an equal chance (or probability) of being selected. For instance, you could write the name of each student on a slip of paper, place all the slips in a box, mix them thoroughly, and draw them at random until you have selected the names of 50 students to survey. Instead of using slips of paper, you could work from a numbered, alphabetical list of all the students and use random number tables or a computer to generate 50 random numbers between 1 and 200 to make your selection.

simple random sampling: the selection of a sample from a population in which every individual or element has the same chance of being selected

An alternative is **systematic sampling**. In systematic sampling, every kth element is selected. In this example, to select 50 students, every 4th student $\left(\frac{200}{50}\right)$ on the list would be selected. That is, $k = 4$. You won't necessarily start with the first student because if that was your routine the first student would have a higher chance of being chosen than the others on the list. To decide where to begin on the list, randomly select a number between 1 and 4. If 3 were chosen, you would start with the 3rd student on the list and then select every 4th student to obtain a sample of size 50.

systematic sampling: the selection of a sample from a population in which every kth individual or element is selected

Neither simple random sampling nor systematic sampling would guarantee that minority groups within your school are fairly represented. Suppose 60 of the students in your school are bused in from a neighbouring town. To ensure a fair representation from that group, divide the school's population into two groups: the 60 students from the neighbouring town and the 140 students from your community. Remember, you need 50 for your sample. Because 50 students is 25% of the school population, randomly select 25% from each group.

25% of $60 = 15$ students
25% of $140 = 35$ students

This sampling technique is called **stratified sampling**.

stratified sampling: the selection of a sample from a population in which the population is divided into groups and the sample is randomly selected from the groups

cluster sampling: the selection of a sample from a population in which the population is first divided into geographic groupings and then a subset of the groupings is selected to sample

A fourth probability sampling technique is **cluster sampling** (or **area sampling**). For example, suppose you want to interview residents in a large city about snow removal. It is not practical for you to go to selected homes randomly in each of the 20 geographical communities into which the city is divided. Instead, use a city map and choose, at random, 4 of the districts. Concentrate on residents of those 4 geographical areas.

multistage sampling: combinations of two or more probability sampling techniques

Sampling techniques, in practice, are generally not as simple as the ones just outlined. Often, procedures from two or more probability sampling techniques are combined. A combination of probability sampling techniques is called **multistage sampling**.

Example

You are a reporter for a local radio station. You want to gather opinions about an upcoming civic election. Describe two non-probability sampling techniques you could use.

convenience sampling: a non-probability sampling technique in which the sample is chosen at the convenience of the surveyor

self-selected sampling: a non-probability sampling technique in which individuals of a population select themselves to participate as members of the sample

Solution

Convenience Sampling

You could stand on a street corner and interview passers-by. You could question customers at a popular restaurant where you know people gather, over coffee, to exchange views. These samples are drawn for your convenience.

Self-Selected Sampling

You could ask listeners to call in or e-mail their opinions. People make up their own minds about whether to participate in the survey. These are self-selected samples.

4. Turn to pages 368 and 369 of *MATHPOWER™ 10* and answer questions 17, 19, 24, 25, 27.a. and 27.b. of "Applications and Problem Solving."

Compare your responses with those in the Appendix, Section 1: Activity 1.

Now Try This

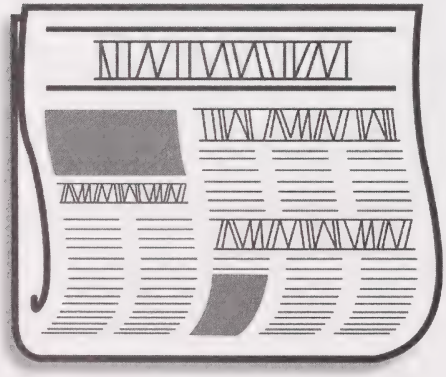
Have you watched stage performers do feats of mental arithmetic that amaze the audience? Many of those "tricks" are based on shortcuts that, once you are shown them, are easily understood. One of those shortcuts involves multiplying by multiples of 9.

5. Turn to page 363 of *MATHPOWER™ 10* and answer questions 1 to 22 of "Mental Math: Multiplying by Multiples of 9."

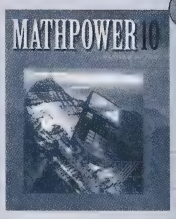
Compare your responses with those in the Appendix, Section 1: Activity 1.

Looking Back

In this activity, you chose and justified sampling techniques that will result in an appropriate sample that reflects a given population. These techniques included both probability and non-probability sampling techniques.

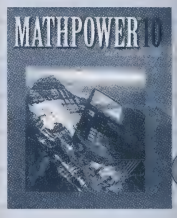


Scan the newspaper for articles that report findings of research based on samples. Cut out two of those articles and paste them in your journal. Describe, in your own words, how the researchers selected their samples. Comment on the reasons why you feel those sampling techniques were or were not appropriate for the population in question.



Mathematical Process

- [ ] Communication
- [ ] Connection
- [ ] Estimation
- [x] Mental Math
- [ ] Problem Solving
- [ ] Reasoning
- [ ] Technology
- [ ] Visualization



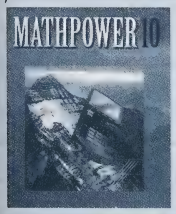
Mathematical Process

- [x] Communication
- [ ] Connection
- [ ] Estimation
- [ ] Mental Math
- [ ] Problem Solving
- [ ] Reasoning
- [ ] Technology
- [ ] Visualization

Activity 2: Inferences and Bias

bias: an unwanted influence that prevents a sample from being truly representative of the population from which it is selected

inference: a generalization or prediction



Have you sat over lunch with friends and, during the course of your conversation, discussed politics? Did you agree with everything that was said? How representative do you think the opinions of the three people in the photograph would be of your views? of the views of your friends? of the views of factory workers? of the views of the majority of people in your province? Suppose you overheard two of the people in the photo say they favoured higher taxes. Could you then claim, "Two-thirds of people in business support an increase in taxes"? Would that claim be valid?

The difference between a sample and a population is a measure of **bias**, a factor that prevents a sample from being truly representative of the population from which it was selected. Researchers want to select unbiased samples so that their **inferences** and generalizations about populations can be defended.

Turn to page 370 of *MATHPOWER™ 10* and read "Inferences and Bias."

1. Answer the following questions on page 370 of the textbook:

a. questions a. to d. of "Explore: Analyze the Questions"
b. questions 1 to 4 of "Inquire"

Compare your responses with those in the Appendix, Section 1: Activity 2.

What are the factors that contribute to a biased sample? Can these factors be eliminated or reduced so that the inferences about a population are less uncertain?

Example

Identify sources of bias in the following samples and surveys.

a. A surveyor is interviewing a homeowner in a residential community. The surveyor asks, "In light of the many concerns homeowners have over noise and the safety of their children, do you support the city's proposal to increase the number of truck routes?"

b. A students' union member is interviewing a sample consisting of 25 female students in a large high school. The interviewer asks, "Do you feel students should be allowed to wear caps in class?"

c. A school's administration is looking at year-round schooling. It wants to survey the views of parents in the neighbourhood. They include a questionnaire in the school's newsletter that is sent home with students. They request that parents mail the completed questionnaires to the school.

Solution

a. This question is leading. If the homeowner answers that he or she does support the city's proposal to increase the number of truck routes, he or she is then put in the position of saying "yes" to noise and "no" to child safety. This example illustrates **response bias**, a bias that occurs because of the construction or phrasing of a survey question.

b. This situation illustrates **selection bias**. The sample consists of female students only. Male students may have different views about wearing caps in class. Stratified sampling that ensures a proportional representation of male and female students would be a more appropriate sampling technique.

c. In this example, there is more than one possible source of bias. It is possible that some of these questionnaires may not reach the parents. Also, it is likely that only parents with strong views or those with time to answer the questionnaire will return them to the administration. When a large number of people sampled do not respond, this source of bias is termed **non-response bias**.

response bias: a bias that occurs as a result of the construction or phrasing of a survey question

selection bias: a bias that occurs as a result of the sample selection process

non-response bias: a bias that occurs because a significant part of the sample selected does not participate in the survey

Turn to page 370 of *MATHPOWER™ 10* and read from the red line on to the bottom of page 371.

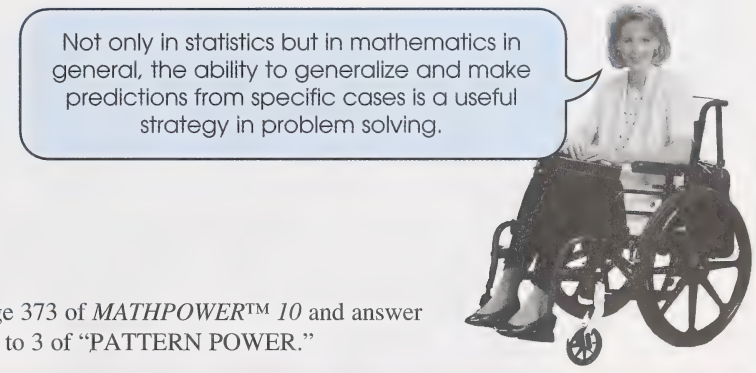
2. Answer the following questions on pages 372 and 373 of the textbook:

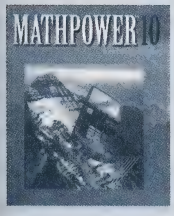
a. questions 1 to 6 of "Practice"
b. questions 7 to 13 of "Practice"
c. questions 14, 17, 21, and 22 of "Applications and Problem Solving"

Compare your responses with those in the Appendix, Section 1: Activity 2.

Mathematical Process
- Communication
- Connection
- Estimation
- Mental Math
- [X] Problem Solving
- Reasoning
- Technology
- Visualization

Now Try This


Not only in statistics but in mathematics in general, the ability to generalize and make predictions from specific cases is a useful strategy in problem solving.



3. Turn to page 373 of *MATHPOWER™ 10* and answer questions 1 to 3 of "PATTERN POWER."

Compare your responses with those in the Appendix, Section 1: Activity 2.

Mathematical Process
- [X] Communication
- Connection
- Estimation
- Mental Math
- Problem Solving
- Reasoning
- Technology
- Visualization

Looking Back

In this activity, you identified possible sources of bias. You should now be able to defend or oppose inferences and generalizations about populations based on the data from samples.

In your journal, design a survey to poll the opinions of students of a certain high school about whether or not students should wear school uniforms. What sampling techniques would you use to try to reduce bias?

What are your opinions about school uniforms? Record your thoughts in your journal.

Follow-up Activities

If you had difficulties understanding the concepts and skills in the activities, it is recommended that you do the Extra Help. If you have a clear understanding of the concepts and skills, it is recommended that you do the Enrichment. You may decide to do both.

Extra Help

Identifying appropriate sampling techniques and making valid inferences about a population from an unbiased sample are key to statistics. There are several excellent sites on the Internet that discuss these issues in detail. Two such sites are as follows:

- **http://www.twu.edu/hs/hs/hs5483/whysamp.htm**
- **http://trochim.human.cornell.edu/kb/sampprob.htm**

Now, here is additional practice on identifying populations, sampling techniques, and sources of bias.

Turn to page 394 of *MATHPOWER™ 10* and answer questions 1 to 11 of "Review."

Compare your responses with those in the Appendix, Section 1: Follow-up Activities, Extra Help.

Mathematical Process

- Communication
- Connection
- Estimation
- Mental Math
- Problem Solving
- Reasoning
- [x] Technology
- Visualization

Enrichment

Random numbers can be obtained from tables or be generated by calculators or computers. Random numbers are used in probability sampling. How can you use your graphing calculator to obtain random numbers?

Example

Generate five numbers at random from 1 to 100 on your graphing calculator.

Solution

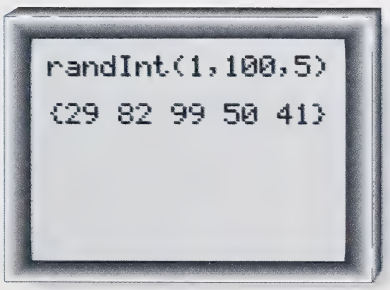
Press MATH, select the PRB (probability) menu using the arrow keys, and press 5 to select "randInt(."

Recall that the examples in this course show the TI-83 (Texas Instruments) graphing calculator.

For this function, you must enter randInt(lower bound, upper bound, number of trials). For this example, press the following:

1 , 1 0 0 , 5) ENTER

Your display should look something like the following:



Remember: *These are random numbers; therefore, your calculator will most likely give you different numbers.*

You could use these numbers to select a sample of 5 students from a school list numbered alphabetically from 1 to 100.

1. Your class has 20 students. You want to randomly choose 10 of those students using a graphing calculator. Describe how you could do this.

2. Turn to page 377 of *MATHPOWER™ 10* and answer questions 1 to 3 of Investigation 3, "Sampling."

Compare your responses with those in the Appendix, Section 1: Follow-up Activities, Enrichment.

Mathematical Process

- Communication
- Connection
- Estimation
- Mental Math
- Problem Solving
- Reasoning
- [X] Technology
- Visualization

Random numbers may also be generated using a computer spreadsheet. The following example outlines the steps for a *ClarisWorks™ 4.0* spreadsheet. Modify the instructions if you are using a different spreadsheet program.

Example

Generate 25 random numbers between 1 and 100 using a spreadsheet.

Solution

Step 1: Open a new spreadsheet file. Enter the formula "=RAND(100)" in cell A1. This formula generates random numbers from 1 to 100 inclusive.

Step 2: Highlight cell A1; then press "shift" and click on cell E5. This highlights cells A1 through E5.

Step 3: Click on the Calculate menu, and select Fill Right.

Step 4: Click on the Calculate menu, and select Fill Down.

Your spreadsheet may look as follows. **Note:** Screens will vary, depending on the random numbers generated.

A1 | x | √ | =RAND(100)

	A	B	C	D	E
1	78	91	93	98	31
2	55	57	48	36	83
3	5	18	79	83	51
4	14	25	38	37	76
5	45	34	66	5	85

3. Use a spreadsheet to generate 50 random numbers between 1 and 500.

Compare your response with the one in the Appendix, Section 1: Follow-up Activities, Enrichment.

Conclusion

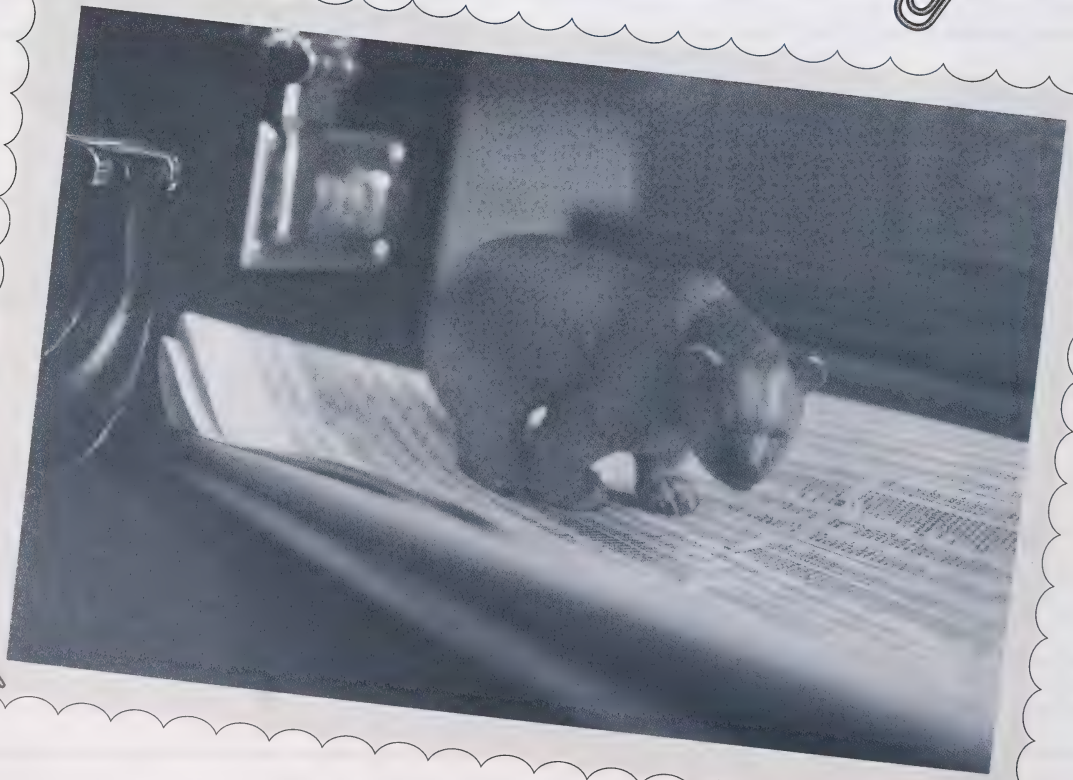
In this section, you were reintroduced to the branch of mathematics called statistics. You investigated probability and non-probability sampling techniques. The probability sampling techniques included random sampling, systematic sampling, stratified sampling, and clustered sampling; the non-probability sampling techniques included convenience sampling and self-selected sampling. You then made inferences and generalizations about the population from which the sample was drawn. You discovered that not all inferences about populations are valid; that is, bias can occur. You also discussed possible sources of bias, and you defended or opposed generalizations about populations based on data from samples.

The parts in your engine are manufactured to stringent quality controls. Not every component is inspected or tested. Samples are selected, they are tested, and inferences are made about the quality of all the parts manufactured in a particular run on the assembly line. What is the probability that one of the components in the engine of your car is faulty?

Assignment

Turn to Assignment Booklet 1A and complete the assignment for Section 1.

Section 2



Numerical Data

In the world today, a secure financial future involves making wise decisions. Financial advisors help individuals make appropriate choices. Being able to sort through the maze of insurance options, business and personal loans, mortgages, and investment vehicles (such as bank deposits, guaranteed investment certificates, stocks, bonds, and mutual funds) involves studying tables and trends, making use of your own analytical skills, and gauging the advice of experts. Computers can help to remove much of the mystery by helping you sort through the information.

In this section, you will use many of the same techniques. You will analyse numerical data in printed and in computer-generated tables. You will then look for trends, patterns, and interrelationships. You will also investigate and manipulate the data to solve problems and make decisions.

Activity 1: Analysing Data in Tables

Like most people, the purchase of a home is one of the largest investments you are likely to make. Deciding on a neighbourhood, finding the right house, negotiating a fair purchase price, and closing the deal are only part of the picture when you decide to buy. You will probably have to borrow a substantial percentage of the cost. Loans for houses, where the house is used as collateral, are called home **mortgages**. Available from trust companies, banks, and credit unions, your monthly payments will depend on the amount of the loan, the interest rates, and the period of time required to pay off the mortgage. Mortgage tables or computer spreadsheet programs can be used to determine your monthly payments and the total amount paid over the life of the mortgage.

	A	B			C		
1	Mortgage	20-Year Mortgages			25-Year Mortgages		
2	Amount	6.0%	6.5%	7.0%	6.0%	6.5%	7.0%
3	20 000.00	$142.44	$148.10	$153.86	$127.98	$133.96	$140.08
4	21 000.00	$149.56	$155.51	$161.56	$134.36	$140.66	$147.09
5	22 000.00	$156.68	$162.91	$169.25	$140.76	$147.36	$154.09
6	23 000.00	$163.80	$170.32	$176.94	$147.16	$154.06	$161.10

This is just one example of tables and spreadsheets you will be exploring in this activity. You will be expected to describe the relationships among data—between rows of data and between columns of data—both in words and using equations. Enjoy!

Mathematical Process

- Communication
- [X] Connection
- Estimation
- Mental Math
- Problem Solving
- Reasoning
- Technology
- Visualization

mortgage: a loan that holds real property as collateral

Example

Use the preceding monthly mortgage table to answer the following:

a. You need to take out a $20 000 mortgage to buy a house. Interest rates are at 7% interest per annum. You are trying to decide between a 20-year mortgage and a 25-year mortgage. What is the difference between the monthly payments for a 20-year mortgage and a 25-year mortgage?

amortize: to repay, as in a mortgage

b. Which will cost you more, a $20 000 mortgage at 7% **amortized** over 20 years or over 25 years? Explain the difference.

c. You need $43 000 to purchase a home. Interest rates are at 6%. What would your monthly payment be for a 20-year mortgage?

d. What is the monthly payment for a 25-year, $60 000 mortgage at 6.5%?

Solution

a. The monthly payment for a 20-year, $20 000 mortgage at 7% is $153.86. If the loan is amortized over 25 years, the monthly payment is $140.08; the second payment is $13.78 less. Does that mean the 25-year mortgage is cheaper? To find out, read on!

b. For the 20-year mortgage, you will pay a total of

$$\$153.86 \times 12 \times 20 = \$36\,926.40$$

You end up paying $\$36\,926.40 - \$20\,000.00 = \$16\,926.40$ in interest.

For the 25-year mortgage, you will pay a total of

$$\$140.08 \times 12 \times 25 = \$42\,024.00$$

This time, the interest is $\$42\,024.00 - \$20\,000 = \$22\,024.00$.

For a 25-year mortgage, there are five additional years of payments. Therefore, you will pay $\$22\,024.00 - \$16\,926.40 = \$5097.60$ more in interest. Remember, the shorter the repayment period, the less interest you will have to pay, even though the monthly payments are higher for the shorter-term mortgage.

c. To find the monthly payment for a 20-year, \$43 000 mortgage at 6%, simply add the monthly payments for a 20-year, \$20 000 mortgage at 6% and a 20-year, \$23 000 mortgage at 6%.

$$\begin{array}{rl} & \text{Monthly payment for a 20-year, \$20 000 mortgage at 6\%} = \$142.44 \\ + & \text{Monthly payment for a 20-year, \$23 000 mortgage at 6\%} = \$163.80 \\ \hline & \text{Monthly payment for a 20-year, \$43 000 mortgage at 6\%} = \$306.24 \end{array}$$

d. The monthly payment for a 25-year, \$60 000 mortgage at 6.5% is three times larger than the monthly payment for a 25-year, \$20 000 mortgage at 6.5%.

Therefore, the monthly payment is $3 \times \$133.96 = \$401.88$.

Turn to page 54 of *MATHPOWER™ 10* and read "Explore: Analyze the Data."

1. Answer questions 1 to 5 of "Inquire."

Compare your responses with those in the Appendix, Section 2: Activity 1.

Young people are often advised that if they want to become financially secure, they have a great advantage over older individuals. Young people have time on their side! If they make regular deposits into a savings account, eventually the interest earned on those savings, if left in the account, will also bear interest. **Compound interest** accelerates the growth of your investments.

Example

Nina is interested in how her savings will grow over time. She designs a spreadsheet program that allows her to enter different figures for the principal in row 3 and to enter different interest rates in row 5. Right now the spreadsheet is set up for a deposit of \$100 in a savings account that yields 8%/a.

compound interest: interest that is paid at regular intervals and added to the principal for the next interest period

Mathematical Process

- Communication
- [X] Connection
- Estimation
- Mental Math
- Problem Solving
- Reasoning
- Technology
- Visualization

	A	B	C	D
1	**Compound Interest**			
2				
3	**Principal**	$100.00		
4				
5	**Interest Rate/Period**	8		
6				
7	**Period**	**Principal**	**Interest**	**Amount**
8	1	$100.00	$8.00	$108.00
9	2	$108.00	$8.64	$116.64
10	3	$116.64	$9.33	$125.97
11	4	$125.97	$10.08	$136.05
12	5	$136.05	$10.88	$146.93
13	6	$146.93	$11.76	$158.69
14	7	$158.69	$12.69	$171.38
15	8	$171.38	$13.71	$185.09
16	9	$185.09	$14.81	$199.90
17	10	$199.90	$15.99	$215.89
18	11	$215.89	$17.27	$233.16
19	12	$233.16	$18.66	$251.82

a. Explain how the amount in cell D8 is determined.

b. Outline how the amounts in cells B9, C9, and D9 are calculated.

c. How much interest would Nina earn after 12 years?

d. If Nina spent the interest she earned every year, how much interest would she earn in 12 years?

e. If Nina had $105 to deposit, how much would she have after 12 years if interest is 8% compounded annually?

Solution

a. The amount in cell D8 is the interest earned at 8% after 1 year added to the principal.

$$\begin{aligned}\text{Interest} &= 8\% \text{ of the initial deposit} \\ &= 0.08 \times \$100.00 \\ &= \$8.00\end{aligned}$$

$$\begin{aligned}\therefore \text{ Amount in D8} &= \text{Principal} + \text{Interest} \\ &= \$100.00 + \$8.00 \\ &= \$108.00\end{aligned}$$

b. The amount in cell B9 is the principal plus interest from the first year. This is the amount that will earn interest in the second year. Notice that the amount in B9 is the same as D8. This pattern continues throughout the table. If the rows are calculated using data from previous rows, then the rows are said to be **related recursively**.

recursive relationship: a relationship among the terms of a sequence for which each term is calculated from the previous term according to the same rule

The amount in C9 is the interest earned during the second year.

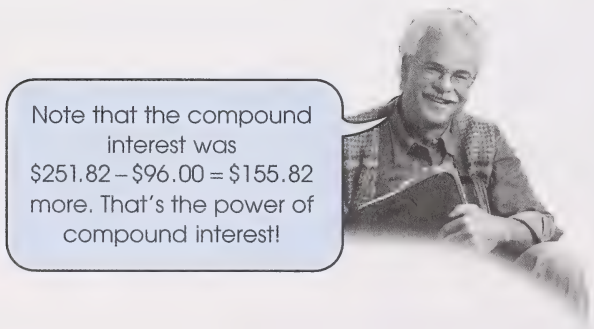
$$\begin{aligned}\text{Interest} &= 8\% \text{ of the initial deposit} \\ &= 0.08 \times \$108.00 \\ &= \$8.64\end{aligned}$$

$$\begin{aligned}\therefore \text{ Amount in D9} &= \text{Principal} + \text{Interest} \\ &= \$108.00 + \$8.64 \\ &= \$116.64\end{aligned}$$

c. $$\begin{aligned}\text{Total interest earned after 12 years} &= \text{Account Balance} - \text{Original Deposit} \\ &= \$251.82 - \$100.00 \\ &= \$151.82\end{aligned}$$

d. If Nina spent her interest every year, she would only earn interest on the amount of her original deposit. The total interest can be found using the **simple interest formula**.

$$\begin{aligned}\text{Interest} &= \text{Principal} \times \text{Rate} \times \text{Time} \\ &= \$100.00 \times 0.08 \times 12 \\ &= \$96.00\end{aligned}$$



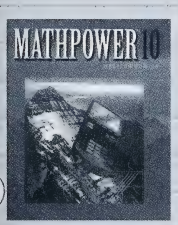
e. If Nina had \$105 to deposit, the accumulated amount would be 1.05 times the figure in the table, because

$$\frac{\$105}{\$100} = 1.05$$

The account balance would be $1.05 \times \$251.82 = \$264.41$.

Be careful with larger amounts. Because the amounts in the table are correct to two decimal places, there will be errors introduced through rounding. For instance, if Nina had \$45 000.00, the account balance after 12 years, as suggested from the table, would be $450 \times \$251.82$ or \$113 319.00. In fact, she would only have \$113 317.66, which is \$1.34 less. The difference is small, but you should be aware that differences will occur!

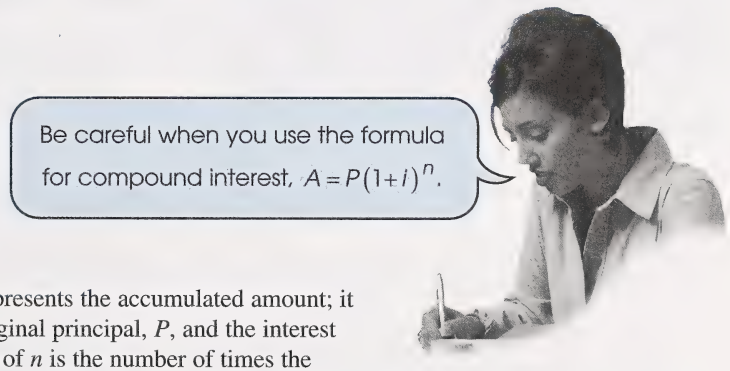
In the next two examples, you will explore a formula for compound interest that you can use to check spreadsheet amounts.



Turn to page 55 of *MATHPOWER™ 10*. Read the two paragraphs at the top of the page and work through Examples 1 and 2.

2. Answer questions 1 to 5 of "Practice," on page 57 of the textbook.

Compare your responses with those in the Appendix, Section 2: Activity 1.

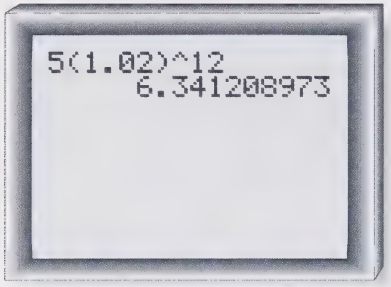


The variable A represents the accumulated amount; it consists of the original principal, P, and the interest earned. The value of n is the number of times the interest is calculated, that is, the number of **interest periods**. Recall from your previous studies in mathematics that i is the interest rate per interest period. For instance, if the annual rate is 8% and the interest is compounded quarterly, then

interest period, the time period for which interest is calculated

$$i = \frac{8\%}{4}$$
$$= 2\% \text{ or } 0.02$$

To evaluate an expression such as $5(1.02)^{12}$ on your graphing calculator, press the following:



Now, look at one more example. This time you aren't earning interest; you are paying interest. You are repaying a car loan.

Turn to page 56 of *MATHPOWER™ 10* and work through Example 3.

3. Answer questions 9 to 12 and 15 to 17 of "Applications and Problem Solving" on pages 57 to 59.

Compare your responses with those in the Appendix, Section 2: Activity 1.

Now Try This

In this activity, you searched for patterns in tables. The search for patterns is the primary task of a mathematician when problem solving. A mathematician looks for the pattern or rule, then explains the rule in verbal or symbolic form. A mathematician will use the generalized rule to extend the problem or to explore similar problems.

4. Turn to "GETTING STARTED" on page 52 of *MATHPOWER™ 10* and answer questions 1 to 4 of Investigation 1, "Patterns in Numbers and Letters."

Compare your responses with those in the Appendix, Section 2: Activity 1.

Mathematical Process

- Communication
- Connection
- Estimation
- Mental Math
- Problem Solving
- Reasoning
- [X] Technology
- Visualization

Mathematical Process

- Communication
- Connection
- Estimation
- Mental Math
- Problem Solving
- [X] Reasoning
- Technology
- Visualization

Mathematical Process
- [x] Communication
- [ ] Connection
- [ ] Estimation
- [ ] Mental Math
- [ ] Problem Solving
- [ ] Reasoning
- [ ] Technology
- [ ] Visualization

Looking Back

In this activity, you studied tables. You used words and symbols to describe the data and interrelationships in a table with rows that are related recursively or with rows that are independent of each other.

Do you think you will use skills in analysing tables in your future career? If so, in what way? What are your career goals, and how will mathematics help you achieve those goals? Write your thoughts in your journal.

Activity 2: Creating and Modifying Tables

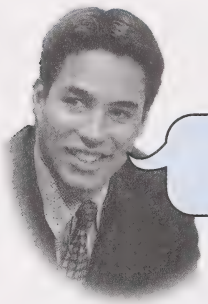
Mathematical Process
- [ ] Communication
- [x] Connection
- [ ] Estimation
- [ ] Mental Math
- [ ] Problem Solving
- [ ] Reasoning
- [x] Technology
- [ ] Visualization

In today's business world, the computer is an indispensable tool. Financial software is tailored to a company's needs. Before decisions are made, or projects initiated, various scenarios must be explored. Computer models can be used to analyse the effects of possible changes in costs and income. The following are some questions a company might consider:

- What would happen if interest rates rose?
- How would changes to the price of a product affect sales?
- How stable is the market?
- Will the cost of raw materials rise?
- How would raises in workers' salaries and benefits affect profits?

Tables and graphs are prepared to summarize the results of this analysis. The information must be timely, logically presented, clear, and easily understood.

Spreadsheets are often an integral part of this data analysis and presentation.



A spreadsheet is a computer-generated arrangement of data in rows and columns.

In this activity, you will use spreadsheets. **Note:** If you do not have access to a computer and a spreadsheet program, you should read the information on spreadsheets so that you are aware of how computers can assist you. You should perform the operations using a calculator.

When you open a new spreadsheet document, you see a grid of **columns** and **rows** like this:

	A	B	C	D
1				
2				
3				
4				

The top of the grid contains the column headings (labelled A, B, C, ...). The left side of the grid contains the row headings (labelled 1, 2, 3, 4, ...).

A **cell** is formed at the intersection of each column and row. For example, the cell at the intersection of column A and row 1 is identified as cell A1. The notation A1 is the **cell address**. You will use the cell address when you write spreadsheet formulas.

The active or selected cell is called the **current cell**. The current cell has a border around it. In a new document, cell A1 is the current cell.

You can select another cell by clicking on that cell.

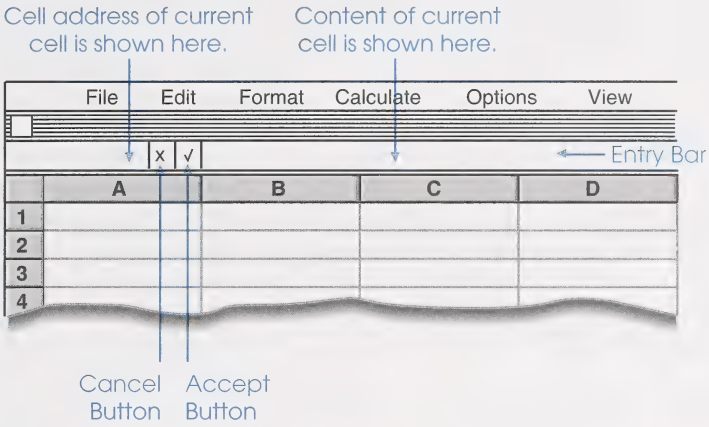
You can also move around the spreadsheet in the following ways:

- The "return" key moves the selection one cell down.
- The "tab" key moves the selection one cell to the right.
- The arrow keys move the selection one cell in the direction of the arrow.

Mathematical Process

- Communication
- Connection
- Estimation
- Mental Math
- Problem Solving
- Reasoning
- [X] Technology
- Visualization

You use the **entry bar** to enter data in a spreadsheet. The entry bar is above the column headings. It identifies the cell address and the contents of the current cell.



To enter data in a cell, select a cell and type the data, but do **not** press "return." The data will appear in the entry bar as you type. (If you make an error, you can backspace to make the correction.) Confirm the entry by clicking on the **accept button** or by pressing "return." When you confirm the entry, data in the entry bar is displayed in the cell.

If the data will not fit into a cell, you can resize the column. One way to do this is to drag the right edge of the column heading with the mouse.

Spreadsheet formulas show how two or more cells are related. Here are some points to remember about spreadsheet formulas:

- Always begin a spreadsheet formula with an equal sign (=).
- Use cell addresses instead of variables in spreadsheet formulas.
- Use an asterisk (*) for multiplication.
- Use a forward slash (/) for division.

For example, to find the sum of the values in cells B5 and B6, you would use the following formula:

= B5 + B6

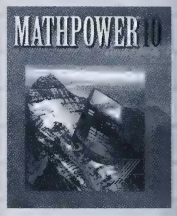
To find the product of cells A1 and B3, you would use the following formula:

= A1 * B3

In this activity, you will look into the process of preparing and modifying tables using computer spreadsheets. In previous activities, you have used tables that were created using spreadsheets. An electronic spreadsheet allows you to organize data in rows and columns. Each cell in a spreadsheet can contain words, numbers, or formulas. You will discover how to modify spreadsheet tables by entering new numbers or formulas in cells in order to test and model different scenarios. For instance, you will look at loan payments—how they change when the interest rate changes or when the length of the loan changes.

Recall that the examples in this activity use *ClarisWorks™ 4.0*. Even though most spreadsheets are similar, if you have a different spreadsheet program on your computer, you may have to consult the user's guide to adapt the steps outlined.

The following example is taken from Investigation 1, "Interest Calculated Annually," on page 86 of *MATHPOWER™ 10*.



Example

Claudia has negotiated an $80 000 loan. The annual interest rate is 7%. With a fixed annual payment of $13 397.42, she will pay the loan off in 8 years. Set up a spreadsheet, similar to the following, that calculates the opening balance, the interest charged, and the closing balance for each year.

	A	B	C	D	E	F
1	Year	Opening Balance ($)	Annual Interest Rate (%)	Interest ($)	Annual Payment ($)	Closing Balance ($)
2	1	$80000.00	7.00%		$13397.42	
3	2		7.00%		$13397.42	
4	3		7.00%		$13397.42	
5	4		7.00%		$13397.42	
6	5		7.00%		$13397.42	
7	6		7.00%		$13397.42	
8	7		7.00%		$13397.42	
9	8		7.00%		$13397.42	

Solution

Step 1: Open a new spreadsheet.

Step 2: Type the headings in cells A1 through to F1 (as shown). You may wish to bold the headings in order to set them apart visually from the data.

	A	B	C	D	E	F
1	Year	Opening Balance ($)	Annual Interest Rate (%)	Interest ($)	Annual Payment ($)	Closing Balance ($)

Note: You may have to adjust the column widths and the row heights to accommodate the text. Consult the user's guide for details.

Step 3: Select column B by clicking on the header. Now, click on the Format menu and select "Number..."; then select "Currency." This will express all values in column B in dollars and cents.

Do the same for columns D, E, and F, since the interest, annual payment, and closing balance should also be expressed in dollars and cents.

Step 4: Select column C by clicking on the header. Now, click on the Format menu and select "Number..."; then select "Percent." This will express all values in column C as a percent. **Note:** This means that whenever you enter a percentage in this column, you must type in the decimal equivalent of that percent. For example, to insert 7% in cell C2, you must enter "0.07" (7% = 0.07).

Step 5: Enter the following values for the first year. Format cells wherever calculations occur.

- In cell A2, enter "1" to represent the first year of the loan.
- In cell B2, enter "80000," since the opening balance of the loan is $80 000.
- In cell C2, enter "0.07," since the annual interest rate is 7%.
- In cell D2, you want to calculate the interest for the year, which is the product of B2 and C2. To do this, enter the formula, "=B2*C2" and press "enter" or click on the Accept button (☑). ("$5600.00" will appear.)
- In cell E2, enter "13397.42," since Claudia will make an annual payment of $13 397.42.
- In cell F2, you want to calculate the year's closing balance. To do this, enter the formula "=B2+D2-E2" and press "enter." ("$72202.58" will appear.)

Your spreadsheet should look as follows:

	A	B	C	D	E	F
1	Year	Opening Balance ($)	Annual Interest Rate (%)	Interest ($)	Annual Payment ($)	Closing Balance ($)
2	1	$80000.00	7.00%	$5600.00	$13397.42	$72202.58

Step 6: Format the next row in order to calculate the information for the second year of the loan. Do the following:

- In cell A3, enter the formula "=A2+1" so it shows that it is the following year.
- In cell B3, enter the formula "=F2," since the opening balance for the second year is the same as the closing balance of the first year.
- In cell C3, enter the annual interest rate (7%).
- In cell D3, enter the formula "=B3*C3" to calculate the interest for the second year.
- In cell E3, enter the annual payment.
- In cell F3, enter the formula "=B3+D3-E3" to calculate the closing balance for the second year.

Your spreadsheet should look as follows:

	A	B	C	D	E	F
1	Year	Opening Balance ($)	Annual Interest Rate (%)	Interest ($)	Annual Payment ($)	Closing Balance ($)
2	1	$80000.00	7.00%	$5600.00	$13397.42	$72202.58
3	2	$72202.58	7.00%	$5054.18	$13397.42	$63859.34

Step 7: Complete the spreadsheet for the 8-year loan. Highlight cells A3 to F9; then click on the Calculate menu and select "Fill Down."

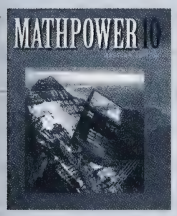
Your spreadsheet should look as follows:

	A	B	C	D	E	F
1	Year	Opening Balance ($)	Annual Interest Rate (%)	Interest ($)	Annual Payment ($)	Closing Balance ($)
2	1	$80000.00	7.00%	$5600.00	$13397.42	$72202.58
3	2	$72202.58	7.00%	$5054.18	$13397.42	$63859.34
4	3	$63859.34	7.00%	$4470.15	$13397.42	$54932.07
5	4	$54932.07	7.00%	$3845.25	$13397.42	$45379.90
6	5	$45379.90	7.00%	$3176.59	$13397.42	$35159.07
7	6	$35159.07	7.00%	$2461.14	$13397.42	$24222.79
8	7	$24222.79	7.00%	$1695.60	$13397.42	$12520.96
9	8	$12520.96	7.00%	$876.47	$13397.42	$0.01

Note that there is a balance of $0.01 at the end of year 8. Simply adjust the final payment so that year 8 shows a zero balance.

Your spreadsheet should look as follows:

	A	B	C	D	E	F
1	Year	Opening Balance ($)	Annual Interest Rate (%)	Interest ($)	Annual Payment ($)	Closing Balance ($)
2	1	$80000.00	7.00%	$5600.00	13397.42	$72202.58
3	2	$72202.58	7.00%	$5054.18	13397.42	$63859.34
4	3	$63859.34	7.00%	$4470.15	13397.42	$54932.07
5	4	$54932.07	7.00%	$3845.25	13397.42	$45379.90
6	5	$45379.90	7.00%	$3176.59	13397.42	$35159.07
7	6	$35159.07	7.00%	$2461.14	13397.42	$24222.79
8	7	$24222.79	7.00%	$1695.60	13397.42	$12520.96
9	8	$12520.96	7.00%	$876.47	13397.43	$0.00



Turn to "TECHNOLOGY" on page 86 of *MATHPOWER™ 10* and read "Using a Spreadsheet."

1. Answer the following questions on page 86 of the textbook:

a. questions 1.b., 1.c., and 2 of Investigation 1, "Interest Calculated Annually"
b. Investigation 2, "Interest Calculated Monthly"

Compare your responses with those in the Appendix, Section 2: Activity 2.

In the previous questions, you were given the amount of each payment required to pay off the loan. Spreadsheets have built-in formulas that allow you to calculate those payments.

Example

Leslie borrowed $4000 to purchase a car and will repay the loan in equal monthly instalments. The interest is calculated monthly on the opening balance, and the payment is due at the end of the month.

a. If the annual interest rate is 6% and the loan is to be repaid in one year, determine the monthly payments. Show the opening balance, the interest charged, and the closing balance for each month.

b. How would the monthly payments change if the loan were repaid over two years? How much more interest would Leslie pay?

c. For an annual interest rate of 7%, what are the monthly payments if a $10 000 loan is to be repaid in one year?

Solution

a. Because you want answers to different scenarios, it is best that you set up a spreadsheet that allows you to change the principal, annual interest rate, and terms of the loan.

Step 1: Open a new spreadsheet.

Step 2: Enter the headings as shown in the following spreadsheet:

	A	B	C
1	**Consumer Loan with Monthly Payments**		
2			
3	**Number of Years**		
4	**Annual Rate**		
5	**Principal**		
6	**Monthly Payment**		
7			
8	**Opening Balance**	**Interest**	**Closing Balance**

Note: You may have to adjust the columns and rows to accommodate the text. If you need assistance, consult the user's guide.

Step 3: Format the cells so that the annual rate is expressed as a percent and all other values, except for the value for number of years (cell B3), are expressed in dollars and cents. Refer to the previous example if you require help formatting numbers.

Step 4: Enter all of the given information:

Number of Years:	1
Annual Rate:	6.00%
Principal:	$4000.00

Remember to enter "0.06" for 6%.

Step 5: In cell B6, enter a formula that automatically calculates the monthly payment (PMT). You can enter this formula exactly as it appears in the formula bar of the following spreadsheet, or you can select the appropriate formula from a given list in the program.

To retrieve a formula from the program, click on the Edit menu and select "Paste Function." In the Paste Function window, select "PMT(rate, nper, pv, fv, type)" and click "OK." This will paste the formula into the entry bar.

Next, replace the five variables inside the parentheses as follows:

- The variable "rate" asks for the interest rate per interest period to be entered. Because the payments are monthly, you must divide the annual rate (cell B4) by 12. Therefore, replace "rate" with "B4/12."

- The variable "nper" asks for the number of periods to be entered. Because there are 12 months in a year, replace "nper" with "B3*12."

- The variable "pv" asks for the initial loan (principal) to be entered. Therefore, replace "pv" with "B5."

- The variable "fv" asks for the future value (the amount owing when the period of the loan is over) to be entered. Because the loan is to be paid off at the end of the period, replace "fv" with "0."

- The variable "type" asks for the type of loan payment (for example, when the payment is made) to be entered. In this program, you enter a "1" if the payments are made at the beginning of each month and a "0" if the payments are made at the end of each month. Therefore, replace "type" with "0."

Because a payment **reduces** the amount owing, it is negative. Therefore, in order to display each payment as a positive value, insert a minus sign before "PMT" in the formula.

After you have entered all five variables and inserted the minus sign, press "enter." Your spreadsheet should look as follows:

B6	x	√	=–PMT(B4/12,B3*12,B5,0,0)

	A	B	C
1	**Consumer Loan with Monthly Payments**		
2			
3	**Number of Years**	1	
4	**Annual Rate**	6.00%	
5	**Principal**	$4000.00	
6	**Monthly Payment**	$344.27	
7			
8	**Opening Balance**	**Interest**	**Closing Balance**

Step 6: Enter the following values for the first month. Format the cells wherever calculations occur.

- In cell A9, enter "=B5" to represent the opening balance of the loan.
- In cell B9, enter "=A9*$B$4/12" to have the spreadsheet calculate the amount of interest paid in the first month. Because the rate does not change from row to row, cell B4 is referred to as $B$4. The dollar signs inform the spreadsheet to always go back to cell B4 to get the rate.
- In cell C9, enter "=A9+B9-$B$6" to have the spreadsheet calculate the closing balance for the first month.

Step 7: Enter the following values for the second month.

- In cell A10, enter "=C9" to represent the opening balance of the loan, since the opening balance for the second month is the same as the closing balance for the first month.
- In cell B10, enter "=A10*$B$4/12" to have the spreadsheet calculate the amount of interest paid in the second month. Because the rate does not change from row to row, cell B4 is referred to as $B$4. The dollar signs inform the spreadsheet to always go back to cell B4 to get the rate.
- In cell C10, enter "=A10+B10-$B$6" to have the spreadsheet calculate the closing balance for the second month.

Your spreadsheet should look as follows:

	A	B	C
1	**Consumer Loan with Monthly Payments**		
2			
3	**Number of Years**	1	
4	**Annual Rate**	6.00%	
5	**Principal**	$4000.00	
6	**Monthly Payment**	$344.27	
7			
8	**Opening Balance**	**Interest**	**Closing Balance**
9	$4000.00	$20.00	$3675.73
10	$3675.73	$18.38	$3349.85

Step 8: Complete the table for the last 10 months. Highlight cells A10 to D20; then click on the Calculate menu and select "Fill Down."

Your spreadsheet should look as follows:

	A	B	C
1	**Consumer Loan with Monthly Payments**		
2			
3	**Number of Years**	1	
4	**Annual Rate**	6.00%	
5	**Principal**	$4000.00	
6	**Monthly Payment**	$344.27	
7			
8	**Opening Balance**	**Interest**	**Closing Balance**
9	$4000.00	$20.00	$3675.73
10	$3675.73	$18.38	$3349.85
11	$3349.85	$16.75	$3022.33
12	$3022.33	$15.11	$2693.18
13	$2693.18	$13.47	$2362.38
14	$2362.38	$11.81	$2029.92
15	$2029.92	$10.15	$1695.81
16	$1695.81	$8.48	$1360.02
17	$1360.02	$6.80	$1022.55
18	$1022.55	$5.11	$683.40
19	$683.40	$3.42	$342.55
20	$342.55	$1.71	$0.00

b. To answer this question, simply enter 2 in cell B3. The spreadsheet instantly updates all the values.

	A	B	C	D
1	**Consumer Loan with Monthly Payments**			
2				
3	**Number of Years**	2		
4	**Annual Rate**	6.00%		
5	**Principal**	$4000.00		
6	**Monthly Payment**	$177.28		

The monthly payments are $177.28 if the loan is repaid over 2 years.

Over 1 year, Leslie would pay the following:

$$\begin{aligned}\text{Total Paid} &= \$344.27 \times 12 \\ &= \$4131.24 \text{ (or } \$131.24 \text{ of interest)}\end{aligned}$$

Over 2 years, Leslie would pay the following:

$$\begin{aligned}\text{Total Paid} &= \$177.28 \times 24 \\ &= \$4254.72 \text{ (or } \$254.72 \text{ of interest)}\end{aligned}$$

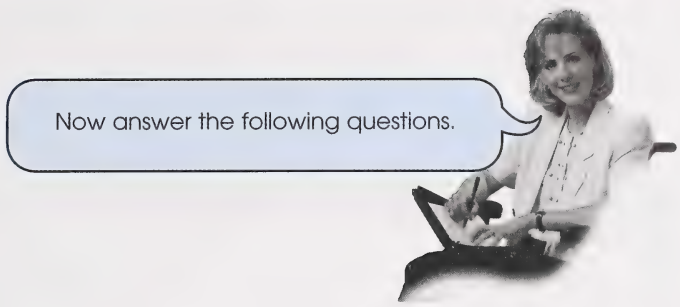
Therefore, Leslie would pay $\$4254.72 - \$4131.24 = \$123.48$ more in interest.

c. To find the monthly payments of a $10 000 loan, at 7% interest, to be repaid within one year, do the following:

- Enter "1" for the number of years (cell B3).
- Enter "0.07" for the interest rate (cell B4).
- Enter "10000" for the principal (cell B5).

	A	B	C	D
1	**Consumer Loan with Monthly Payments**			
2				
3	**Number of Years**	1		
4	**Annual Rate**	7.00%		
5	**Principal**	$10000.00		
6	**Monthly Payment**	$865.27		

According to the spreadsheet, the monthly payments are $865.27.



2. Modify the spreadsheet to include an initial column that tracks the months of the loan, as shown in the following spreadsheet:

	A	B	C	D
1	**Consumer Loan with Monthly Payments**			
2				
3	**Number of Years**	1		
4	**Annual Rate**	7.00%		
5	**Principal**	$10000.00		
6	**Monthly Payment**	$865.27		
7				
8	**Month**	**Opening Balance**	**Interest**	**Closing Balance**
9	1	$10000.00	$58.33	$9193.07
10	2	$9193.07	$53.63	$8381.42
11	3	$8381.42	$48.89	$7565.05
12	4	$7565.05	$44.13	$6743.91
13	5	$6743.91	$39.34	$5917.98
14	6	$5917.98	$34.52	$5087.24
15	7	$5087.24	$29.68	$4251.65
16	8	$4251.65	$24.80	$3411.18
17	9	$3411.18	$19.90	$2565.81
18	10	$2565.81	$14.97	$1715.51
19	11	$1715.51	$10.01	$860.25
20	12	$860.25	$5.02	$0.00

What are the formulas for cells A9, A10, B9, C9, and D9?

3. What is the total interest on an $80 000 loan, borrowed at 9% annual interest, that is repaid monthly over 5 years?

Compare your responses with those in the Appendix, Section 2: Activity 2.

Next, you will investigate a spreadsheet program that calculates compound interest. Be careful, as the percent is expressed as a whole number rather than a decimal fraction. You will have to account for this change!

4. Create a spreadsheet using the following template:

	A	B	C	D
1	**Compound Interest**			
2				
3	**Principal**	$100.00		
4	**Interest Rate Per Period**	8.00%		
5				
6	**Period**	**Principal**	**Interest**	**Amount**
7	1	$100.00	$8.00	$108.00
8	2	$108.00	$8.64	$116.64
9	3	$116.64	$9.33	$125.97
10	4	$125.97	$10.08	$136.05
11	5	$136.05	$10.88	$146.93
12	6	$146.93	$11.75	$158.69
13	7	$158.69	$12.69	$171.38
14	8	$171.38	$13.71	$185.09
15	9	$185.09	$14.81	$199.90
16	10	$199.90	$15.99	$215.89
17	11	$215.89	$17.27	$233.16
18	12	$233.16	$18.65	$251.82

What are the formulas for cells A7, B7, C7, D7, A8, and B8?

5. Use your spreadsheet to calculate the total interest earned on a deposit of $10 000 after 10 years in an account bearing interest at 9% compounded semi-annually.

Compare your responses with those in the Appendix, Section 2: Activity 2.

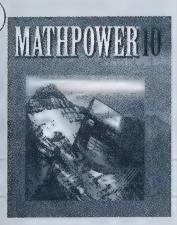
Now Try This

Many maximum and minimum problems can be approached using spreadsheets. The following are but two examples. What should the dimensions of an open box holding $1\ m^3$ be if the amount of material used to make that box is a minimum? What should the dimensions of a rectangular field be if the area of the field is a maximum and it is fenced on three sides with 100 m of fencing?

Turn to "PROBLEM SOLVING" on pages 69 and 70 of *MATHPOWER™ 10* and read "Use a Table or Spreadsheet."

Mathematical Process

- Communication
- Connection
- Estimation
- Mental Math
- [X] Problem Solving
- Reasoning
- [X] Technology
- Visualization



Mathematical Process
- [x] Communication
- [x] Connection
- [ ] Estimation
- [ ] Mental Math
- [ ] Problem Solving
- [ ] Reasoning
- [ ] Technology
- [ ] Visualization

6. Modify the spreadsheet given at the top of page 70 of *MATHPOWER™ 10* so that the road distance decreases by 5 km from row to row. According to the spreadsheet, what is the shortest travelling time?

Compare your response with the one in the Appendix, Section 2: Activity 2.

Looking Back

In this activity, you used spreadsheets to create tables containing rows that were related recursively. Specifically, you looked at consumer loans and compound interest.

What ways can spreadsheets be used in the other courses you are taking in high school? Choose one of those courses and outline the spreadsheet that would assist you. Record your efforts in your journal.

Activity 3: Using a Computer Database

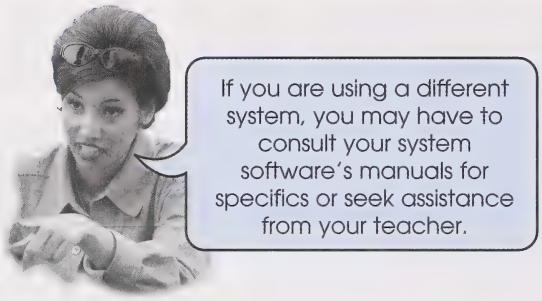
database: a collection of computer records that can be managed by the computer user

Mathematical Process
- [ ] Communication
- [ ] Connection
- [ ] Estimation
- [ ] Mental Math
- [ ] Problem Solving
- [ ] Reasoning
- [x] Technology
- [ ] Visualization

A computer **database** is designed to help you manage information. Once the information has been entered into a database, you can search through that information and find particular facts. You can also sort and select, compare and analyse, and present data in tables and graphs.

In this activity, you will use the Computer Data Bank that accompanies the *MATHPOWER™ 10* textbook. The Computer Data Bank appears on three disks. The disk you use will depend on your software and system requirements. One disk contains a Macintosh version that uses *ClarisWorks™*; a second disk contains a Windows version that supports either *ClarisWorks™* or *Microsoft® Works*; and the third disk has a Window's version that uses *Microsoft® Access*.

The procedures for *ClarisWorks™* for both Macintosh and Windows are included at the back of the Appendix—Computer Data Bank for Macintosh and Computer Data Bank for Windows. The examples presented in this activity are based on the *ClarisWorks™ 4.0* version of the Computer Data Bank for Macintosh.


If you are using a different system, you may have to consult your system software's manuals for specifics or seek assistance from your teacher.

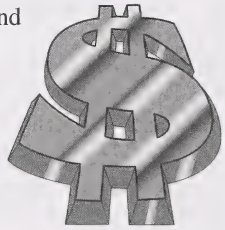
1. Turn to the back of the Appendix and work through Computer Data Bank for Macintosh or Computer Data Bank for Windows, depending on the type of computer you are using. Answer any questions that appear within the exercise.

Compare your responses with those in the Appendix, Section 2: Activity 3.

This exercise is intended to familiarize you with databases. When you have completed the exercise, you should have the skills necessary to complete the questions and explorations in this activity.

Example

Use the Insurance database from the Computer Data Bank disk to find all the records of collision coverage in Alberta for drivers who have had driver education and have driven less than three years. Set up a table for these records with columns for gender, driver's age, claim frequency, and the average cost per claim. Set up an additional column that shows the expected amount to be paid out per policy for each category of driver.

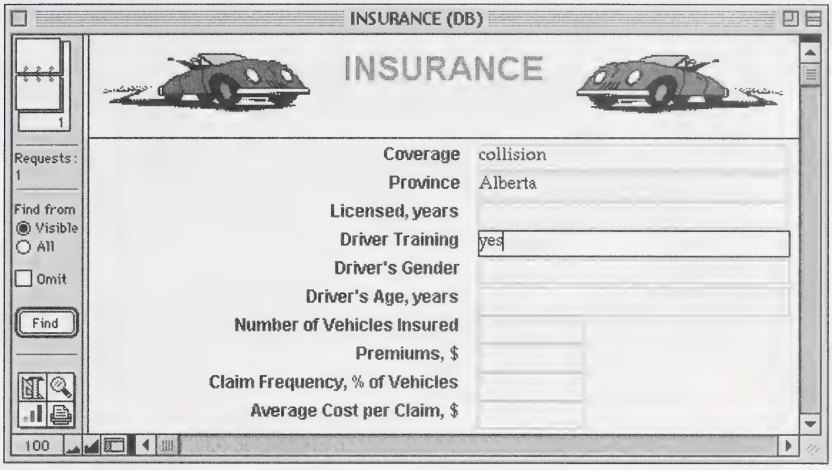


Solution

Step 1: Find all the records of collision coverage for Alberta drivers with driver education who have driven less than three years.

- Open the Insurance database.
- Click on the Layout menu and select "Find."

- In the Coverage box, enter "collision"; in the Province box, enter "Alberta"; and in the Driver Training box, enter "yes."

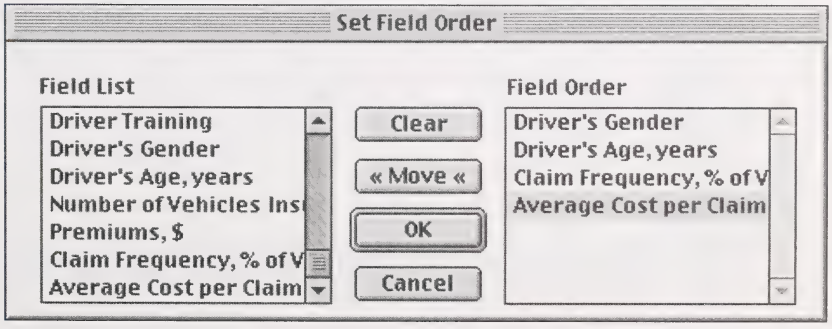


- Click "Find."

There should be 18 records selected, each showing drivers with less than 3 years experience. If more records appear, select the 18 drivers with less than 3 years experience and hide the others.

Step 2: Set up the initial table.

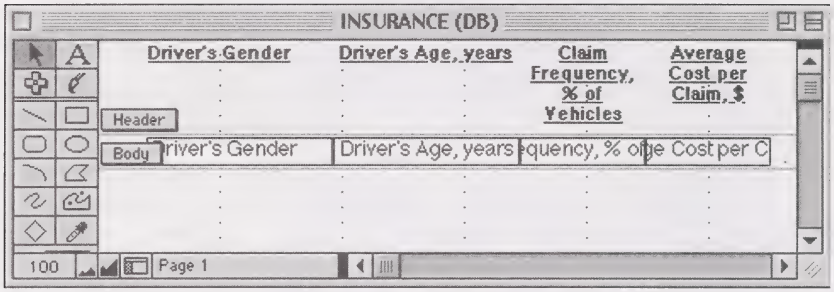
- Click on the Layout menu and select "New Layout."
- Click on the Columnar report radial button; then click "OK."
- From the Field list, select and move "Driver's Gender," "Driver's Age, years," "Claim Frequency, % of Vehicles," and "Average Cost per Claim."



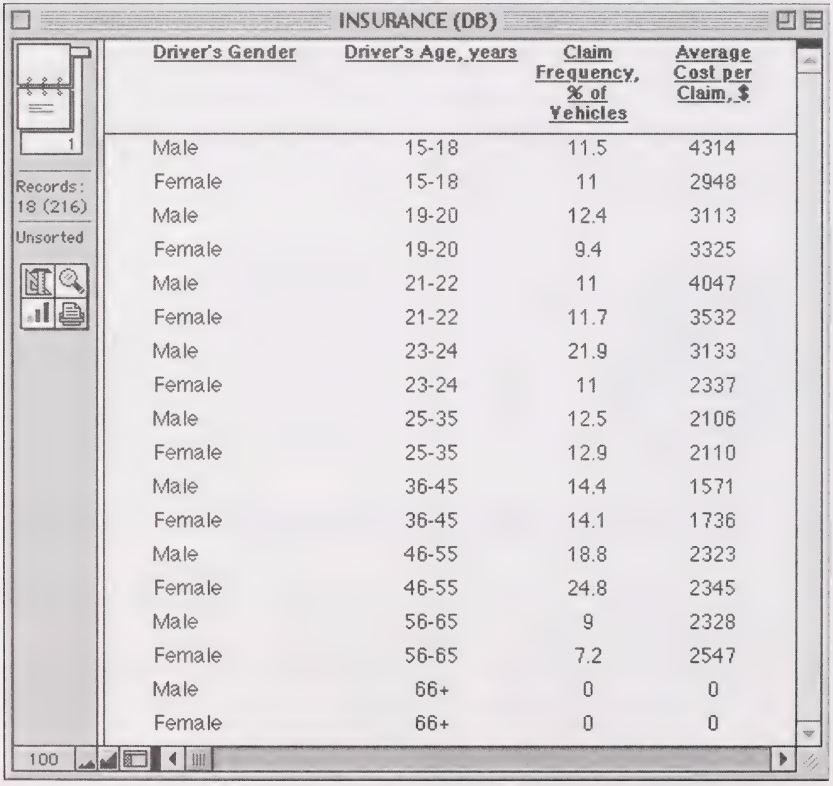
- Click on "OK."

Step 3: Adjust the format of the table.

- Click on the Layout menu and select "Layout." Adjust the Header and Body widths. Reposition the field headings and field values, if necessary.



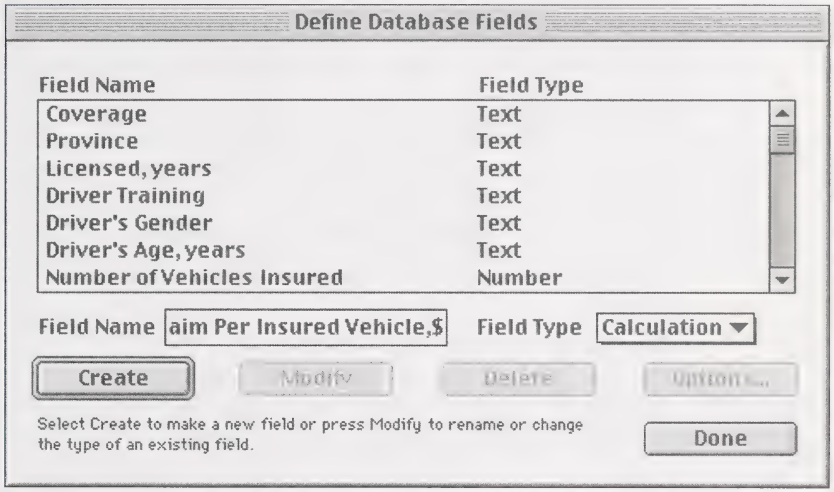
- Click on the Layout menu and select "Browse" to view the table.



Driver's Gender	Driver's Age, years	Claim Frequency, % of Vehicles	Average Cost per Claim, $
Male	15-18	11.5	4314
Female	15-18	11	2948
Male	19-20	12.4	3113
Female	19-20	9.4	3325
Male	21-22	11	4047
Female	21-22	11.7	3532
Male	23-24	21.9	3133
Female	23-24	11	2337
Male	25-35	12.5	2106
Female	25-35	12.9	2110
Male	36-45	14.4	1571
Female	36-45	14.1	1736
Male	46-55	18.8	2323
Female	46-55	24.8	2345
Male	56-65	9	2328
Female	56-65	7.2	2547
Male	66+	0	0
Female	66+	0	0

Step 4: Add a column for the expected claim per insured vehicle.

- Click on the Layout menu and select "Define Fields."
- Enter "Expected Claim Per Insured Vehicle,$" in the Field Name box; then click ▼ at Field Type and select "Calculation."



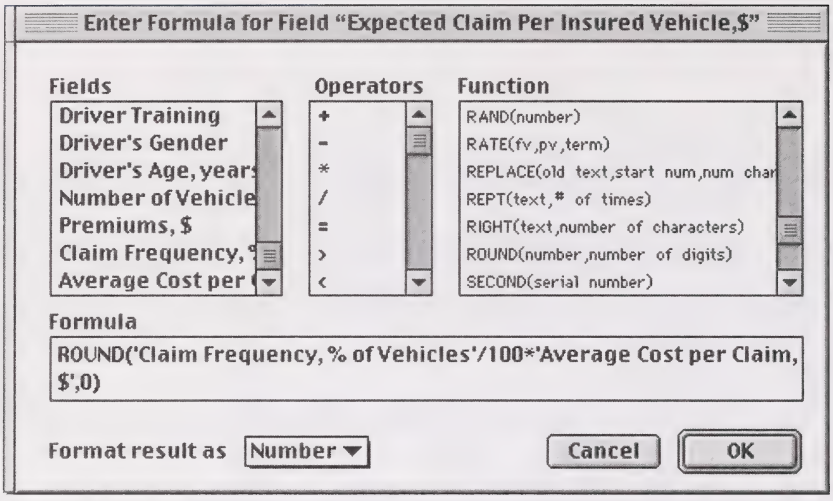
- Click "Create."

Step 5: Define the new field; that is, input how the values in the new column will be calculated.

- In the Function List, select "ROUND(number, number of digits)."
- For the first value in the parentheses ("number"), define the formula for the expected claim. From the Fields list, select "Claim Frequency, % of Vehicles." Next, select the operator "/"; enter "100"; and select the operator "*." Lastly, from the Fields list, select "Average Cost per Claim,$." The formula you defined is as follows:

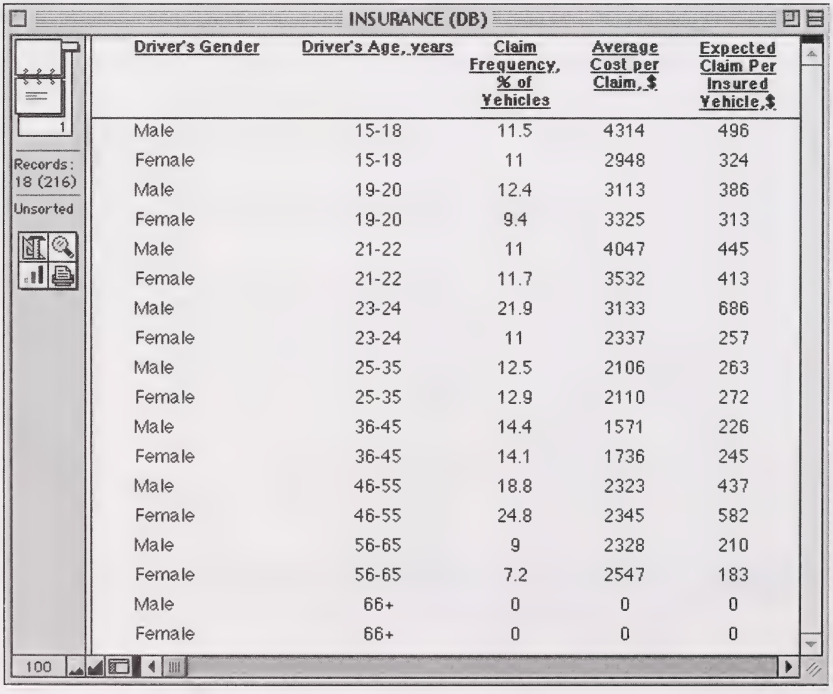
$$\frac{\text{Claim Frequency}}{100} \times \text{Average Cost per Claim}$$

For the second value in the parentheses ("number of digits"), enter "0." This gives no decimal places (rounds to the nearest dollar). Because all other dollar values have been rounded to the nearest dollar, so should the new field.



- Click "OK."
- Click "Done."

Step 5: Adjust the layout of the table. Move the new field name to the Header and the field value to the Body. Select "Browse" to view the table.



Driver's Gender	Driver's Age, years	Claim Frequency, % of Vehicles	Average Cost per Claim, $	Expected Claim Per Insured Vehicle,$
Male	15-18	11.5	4314	496
Female	15-18	11	2948	324
Male	19-20	12.4	3113	386
Female	19-20	9.4	3325	313
Male	21-22	11	4047	445
Female	21-22	11.7	3532	413
Male	23-24	21.9	3133	686
Female	23-24	11	2337	257
Male	25-35	12.5	2106	263
Female	25-35	12.9	2110	272
Male	36-45	14.4	1571	226
Female	36-45	14.1	1736	245
Male	46-55	18.8	2323	437
Female	46-55	24.8	2345	582
Male	56-65	9	2328	210
Female	56-65	7.2	2547	183
Male	66+	0	0	0
Female	66+	0	0	0

Note: If you wish to sort the records by any of the fields, open the Organise menu and select "Sort Records."

Now try the following questions:

2. Which age groups and which gender have the top 3 claim frequencies?

3. Which age groups and which gender have the top 3 claim amounts?

4. Which age groups and which gender have the top 3 expected claim per insured vehicle?

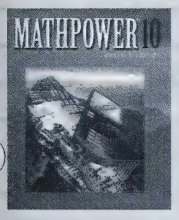
Compare your responses with those in the Appendix, Section 2: Activity 3.

Now you will apply your skills with databases.

5. Turn to "COMPUTER DATA BANK" on page 62 of *MATHPOWER™ 10* and answer the following questions:

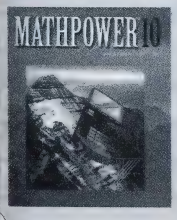
   a. questions 1 to 4 of Investigation 1, "Favourite Type of Movie"
   b. questions 1 to 3 of Investigation 2, "Academy Awards"
   c. questions 1 to 6 of Investigation 3, "Comparing Profits"
   d. question 1 of Investigation 4, "Making Movies"

Compare your responses with those in the Appendix, Section 2: Activity 3.



Mathematical Process

- Communication
- [x] Connection
- Estimation
- Mental Math
- Problem Solving
- Reasoning
- Technology
- Visualization



Now Try This

An important aspect of data analysis, whether you are using spreadsheets or a database, is communicating your results to people who have an interest in your work. Graphs and tables must be supported with the written word. Verbal skills are as important in mathematics as any other endeavour.

6. Turn to "CONNECTING MATH AND ENGLISH" page 87 of *MATHPOWER™ 10* and answer questions 1 to 6 of Investigation 1, "Measuring Readability."

Compare your responses with those in the Appendix, Section 2: Activity 3.

Looking Back

In this activity, you used a database as a tool to manage information. You prepared and analysed tables using the features of the database. You will be using your newly acquired skills in mathematics and in other areas, where the ability to sift through large amounts of information using technology is a great asset.

In your journal, list the features of a database that you feel are most difficult to master. Then outline the steps that would assist a friend in completing tasks that involve these features. Give what you have written to a friend and have them follow your directions exactly as they were written. Were they successful? Revise your procedures as necessary.

Mathematical Process

- [x] Communication
- [ ] Connection
- [ ] Estimation
- [ ] Mental Math
- [ ] Problem Solving
- [ ] Reasoning
- [ ] Technology
- [ ] Visualization

Follow-up Activities

If you had difficulties understanding the concepts and skills in the activities, it is recommended that you do the Extra Help. If you have a clear understanding of the concepts and skills, it is recommended that you do the Enrichment. You may decide to do both.

Extra Help

If you had difficulty setting up spreadsheets, you may wish to investigate the following Internet site:

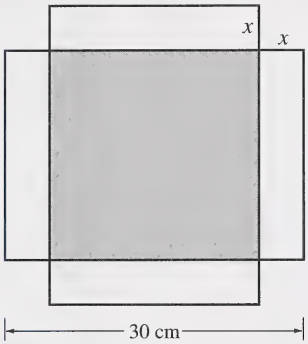
http://mathforum.org/sum95/math_and/spreadsheets/intro.html

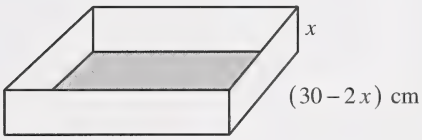
This site explores numerous applications of spreadsheets in mathematics. There are clear directions included for most applications. One of the applications of spreadsheets that you studied in Activity 2 dealt with finding a minimum travelling time. Many problems involving maximum and minimum values can be approached using spreadsheets. Spreadsheets can perform many related calculations quickly, and present the results of these calculations in table format for easy analysis.

Mathematical Process
- Communication
- Connection
- Estimation
- Mental Math
- Problem Solving
- Reasoning
- [x] Technology
- Visualization

Example

A square sheet of cardboard with 30-cm sides is to be made into an open-top box. Equal squares are to be cut from the four corners and the tabs to be turned upward (as illustrated). What should the size of the squares that are cut from the corners be if the volume of the resulting box is a maximum? Use a spreadsheet to answer this question.





Solution

Let the sides of the squares that are cut from the corners be x. Therefore, the resulting box has a square base that is now $(30-2x)$ cm on a side and a height of x cm.

The volume of the box is as follows:

$$\begin{aligned} V &= \ell wh \\ &= (30-2x)(30-2x)(x) \\ &= (30-2x)^2\, x \end{aligned}$$

You could try different values of x and compare the resulting volumes. For example,

If $x = 1$ cm, then $V = (30-2)^2\,(1)$

$$= 784 \text{ cm}^3$$

If $x = 2$ cm, then $V = (30-4)^2\,(2)$

$$= 1352 \text{ cm}^3$$

Rather than performing all of the calculations yourself, let the spreadsheet do the work!

Step 1: Open a new spreadsheet and enter the headings as shown.

	A	B	C	D
1	**Volume of the Box**			
2				
3	**Length of Side of Square**	**Length of Side of Base of Box, 30-2x**	**Height, x**	**Volume**

Step 2: Complete the first row of values.

- Enter "1" in cell A4.
- Enter the formula "=30-2*A4" in cell B4.
- Enter the formula "=A4" in cell C4.
- Enter the formula "=B4^2*C4" in cell D4.

Step 3: To increase the length of the side of each square by 0.5 cm, enter the formula "=A4+0.5" in cell A5.

Step 4: Highlight cells A5 to A17; then click on the Calculate menu and select "Fill Down."

	A	B	C	D
1	**Volume of the Box**			
2				
3	**Length of Side of Square**	**Length of Side of Base of Box, 30-2x**	**Height, x**	**Volume**
4	1	28	1	784
5	1.5			
6	2			
7	2.5			
8	3			
9	3.5			
10	4			
11	4.5			
12	5			
13	5.5			
14	6			
15	6.5			
16	7			
17	7.5			

Step 5: Highlight cell B4 to D17; then click on the Calculate menu and select "Fill Down."

	A	B	C	D
1	Volume of the Box			
2				
3	Length of Side of Square	Length of Side of Base of Box, 30-2x	Height, x	Volume
4	1	28	1	784
5	1.5	27	1.5	1093.5
6	2	26	2	1352
7	2.5	25	2.5	1562.5
8	3	24	3	1728
9	3.5	23	3.5	1851.5
10	4	22	4	1936
11	4.5	21	4.5	1984.5
12	5	20	5	2000
13	5.5	19	5.5	1985.5
14	6	18	6	1944
15	6.5	17	6.5	1878.5
16	7	16	7	1792
17	7.5	15	7.5	1687.5

It appears that cutting squares 5 cm on a side from the corners of the cardboard will result in the largest volume, 2000 cm^3.

Now try the following questions:

1. Are the rows in the preceding example defined recursively?

2. What are the formulas for cells B5, C5, D5, and A6?

3. Starting at $x = 4.5$ cm, produce a similar table where x increases by 0.1 cm. What do you notice?

4. Why was performing the calculations in question 3 important?

Compare your responses with those in the Appendix, Section 2: Follow-up Activities, Extra Help.

Enrichment

In Canada, **mortgages** differ from regular consumer loans. A mortgage is a loan that is secured by real property (such as your home). Miss your payments, the lender has a right to foreclose. Though mortgage payments may be set monthly, bi-monthly, weekly, or even daily, the interest is compounded semi-annually to conform to Canadian law. The standard mortgage, one with monthly payments, is most common. Payment tables that give you the amount of the monthly payment necessary to **amortize** (repay) the loan can be purchased in a bookstore. However, you can easily set up a spreadsheet to perform the calculation for you.

Mathematical Process

- Communication
- [X] Connection
- Estimation
- Mental Math
- [X] Problem Solving
- [X] Reasoning
- [X] Technology
- Visualization

Use the following template:

B6 | x | √ | =B5*(((1+B4/2)^(1/6)-1))/(1-(((1+B4/2)^(1/6)))^(-1*B3*12))

	A	B	C	D	E	F	G
1		CANADIAN MORTGAGE CALCULATOR					
2							
3	Number of Years	25	26	27	28	29	30
4	Annual Rate	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
5	Principal	$2000.00	$2000.00	$2000.00	$2000.00	$2000.00	$2000.00
6	Monthly Payment	$17.89	$17.73	$17.59	$17.47	$17.35	$17.25

The table on the right shows the formulas for selected cells.

Cell	Formula
B6	Refer to the entry bar.
C3	=B3+1
C4	=B4
C5	=B5

The formulas for the remaining cells were obtained by clicking on the Calculate menu and selecting "Fill Right."

Once you have successfully set up this spreadsheet, answer the following questions:

1. What is the monthly payment for a $30 000 mortgage, at 7%, and amortized over 25 years?

2. What is the monthly payment for a $100 000 mortgage, at 10%, and amortized over 30 years? What is the total of all the payments?

3. Write the algebraic formula for the monthly payment in which P = principal, i = interest rate, and n = number of years.

Compare your responses with those in the Appendix, Section 2: Follow-up Activities, Enrichment.

Conclusion

In this section, you analysed numerical data in printed and in computer-generated tables. You looked for trends, patterns, and interrelationships. You used computer spreadsheets and databases to investigate and manipulate data to solve problems and make decisions.

Many of the problems you solved involved finance. In today's financial markets, decisions in distant parts of the world have an effect on society's well-being. Interest rates, wages, stock markets, and businesses in our country are an integral part of the global economy. There is always a need for people that are able to sift through and interpret mountains of information (with the aid of technology) and make sound financial decisions. If you have an interest in finance and business, you might consider a career in these areas.

Assignment

Turn to Assignment Booklet 1B and complete the assignment for Section 2.

Module Summary

In Section 1, you investigated surveys and sampling procedures used to ensure the validity of the information obtained. You discussed possible sources of bias and how to judge the validity of judgements made about populations based on survey data.

In Section 2, you analysed numerical data in tables. You looked for trends, patterns, and interrelationships and used technology to assist you in drawing conclusions based on your analysis.

It is remarkable how interdependent modern society is. You cannot possibly be an expert in every area. So, you must learn to rely on the judgements of others. Every time you get on a plane, go to a doctor, ask a financial planner for advice, call in a repairperson to fix the furnace, or take your car in for repairs, you place your trust in the knowledge and experience of others. The decisions these experts make on your behalf are based on information they gather and their analysis of the problem. Their analysis is grounded in what experience has taught them to expect. The decision-making process of an expert incorporates most of the skills you have mastered in this module.

Final Module Assignment

Turn to Assignment Booklet 1B and complete the final module assignment.

Glossary

Suggested Answers

Computer Data Bank
for Macintosh

Computer Data Bank
for Windows

Glossary

amortize: to repay, as in a mortgage

area sampling: cluster sampling

bias: an unwanted influence that prevents a sample from being truly representative of the population from which it is selected

census: the process of collecting information from all the individuals or elements of a population

cluster sampling: the selection of a sample from a population in which the population is first divided into geographic groupings and then a subset of the groupings is selected to sample

compound interest: interest that is paid at regular intervals and added to the principal for the next interest period

convenience sampling: a non-probability sampling technique in which the sample is chosen at the convenience of the surveyor

database: a collection of computer records that can be managed by the computer user

event: a subset of a sample space

expected value: the theoretically calculated outcome for a set of observations based on probability

inference: a generalization or prediction

In statistics, an inference is a statement made about a population based on the results of a sample.

interest period: the time period for which interest is calculated

mathematical expectation: expected value

mortgage: a loan that holds real property as collateral

If in default, a borrower with a home mortgage forfeits the home to the lender.

multistage sampling: combinations of two or more probability sampling techniques

non-probability sampling: the selection of a sample from a population that does not involve the random selection of elements

non-response bias: a bias that occurs because a significant part of the sample selected does not participate in the survey

outcome: an element of a sample space

population: all of the individuals or elements about which information is collected

principal: the original value of a loan or deposit

probability: the ratio of the number of outcomes of an event to the total number of outcomes possible

probability histogram: a type of bar graph that illustrates the relative probabilities of several distinct events into which a sample space is divided

The probabilities of these events total 1.

probability sampling: the selection of a sample from a population that involves the random selection of elements

recursive relationship: a relationship among the terms of a sequence (or the rows of a table) for which each term (or row) is calculated from the previous term (or row) according to the same rule

response bias: a bias that occurs as a result of the construction or phrasing of a survey question

sample: a part or subset of a population

sample space: the set of all possible outcomes

selection bias: a bias that occurs as a result of the sample selection process

self-selected sampling: a non-probability sampling technique in which individuals of a population select themselves to participate as members of the sample

simple random sampling: the selection of a sample from a population in which every individual or element has the same chance of being selected

spreadsheet: a computer-generated arrangement of data analysis and presentation

statistics: the branch of mathematics that deals with the collection, analysis, and presentation of data and the drawing of conclusions based on the data collected and analysed

stratified sampling: the selection of a sample from a population in which the population is divided into groups and the sample is randomly selected from the groups

survey: the process by which information is collected from a sample

systematic sampling: the selection of a sample from a population in which every *k*th individual or element is selected

term: in finance, the length of time required to repay a loan

tree diagram: a branching diagram illustrating the outcomes of an event

Suggested Answers

Section 1: Activity 1

1. a. Textbook questions a. to c. of "Explore: Make Predictions," p. 364

a. Answers may vary. The majority of grade 10 students in your school should know the capitals of the Canadian provinces.

b. Answers may vary. Do you think most right-handed people put on their right shoe or their left shoe first in the morning?

c. Answers may vary. How do the television networks determine how popular their shows are?

b. Textbook questions 1 and 2 of "Inquire," p. 364

1. There is unlikely to be a consensus among students in your class. Different groups of students in your class will have different opinions.

2. To improve the accuracy of the answers, you should ask a larger number of students, students from other classes, and students from other grades.

Section 1: Activity 1 (continued)

2. Textbook questions 1 to 5 of "Practice," p. 368

1. The population consists of those people watching television on Saturday night.

2. The population consists of those people who brush their teeth.

3. The population consists of young people—people not yet considered to be adults.

4. The population consists of those people who participate in summer water activities.

5. The population consists of those people belonging to the same political party as the politician in question.

3. a. Textbook questions 7 and 8 of "Practice," p. 368

7. To determine the favourite vacation destinations of Canadians, you may wish to limit the population to clients of a local travel agent. Obtain the travel agency's client list, and select a sample of those people on the list. Suppose there are 500 clients listed. If you sample 10% of the population, the sample size is 10% of 500 = 50 clients. Next, number the clients on the original list from 1 to 500; then generate 50 random numbers between 1 and 500 using a calculator or computer. Ask each client who corresponds to the random numbers what his or her favourite travel destination is.

8. The population is all the salmon in a particular river. At various points along the river, net a sample of the salmon. Find the average mass of all the salmon netted.

b. Textbook questions 11 and 12 of "Practice," p. 368

11. Let the population consist of all the students in your school. Suppose there are 1000 students. Decide on an appropriate sample size, say 50 students. You will survey every 20th student $\left(\frac{1000}{50}\right)$ on the school list. Do not start with the 20th student. Select at random a number between 1 and 20. If 7 were chosen, you would begin with student number 7 and then systematically ask every 20th student after that. Students numbered 7, 27, 47, 67, and so on would comprise your sample.

12. To decide the average speed of the cars on a section of highway, you could use a systematic-sampling technique. If you wanted to record the speeds of 100 cars using radar, you might decide to clock every 10th car until your sample consisted of the speeds of 100 cars. You wouldn't necessarily begin with the 10th car, but rather you would randomly select a number between 1 and 10. If the number chosen were 7, you would then record the speeds of cars numbered 7, 17, 27, and so on until you had 100 cars for your sample.

c. Textbook questions 13 and 14 of "Practice," p. 368

13. To apply a stratified sampling procedure to determine which school-related, extra-curricular activity is the most popular, you might divide your school population into groups. These groups may be any of the following:

- male and female
- honour students, average students, and below-average students
- grade 10, grade 11, and grade 12 students

14. To determine what the population's opinions are concerning possible restrictions that might be placed on young drivers, you could divide the population into categories. These categories may be any of the following:

- male and female drivers
- drivers below the age of 21 and drivers 21 years of age or older
- drivers that have had no accidents or traffic violations for the last 5 years and drivers who have had road accidents or traffic violations within the last 5 years

4. Textbook questions 17, 19, 24, 25, 27.a., and 27.b. of "Applications and Problem Solving," pp. 368 and 369

17. a. This is a convenience sample. The population consists of those who purchased that brand of bottled water.

b. The sample is obtained through systematic sampling. The population consists of those who redeemed their money-back coupons.

c. The sample is obtained through simple random sampling. Those people with listed phone numbers form the population.

d. This is an example of stratified sampling. The population consists of those people on the company's mailing list.

e. This is a convenience sample. The population is of those carrying bottled water in the park.

19. a. The people stranded at the airport form a convenience sample.

b. If it is possible to obtain the passenger lists for the past year on carriers who fly within Canada, put the information into a database and sort the passengers according to the number of flights they have taken. Perhaps you want to sample both frequent flyers (people who have flown five times or more a year) and casual travellers. Once you have both lists, you could randomly select people from both lists for your survey on the efficiency of Canadian air travel.

Section 1: Activity 1 (continued)

24. a. Because there are 275 boys in the school, a random sample could contain only boys.

b. A sample containing only boys would not be representative of the school population. It is possible that a girl's point of view on social activities would differ from that of a boy's.

25. a. One student who names six others from memory is not making a random sample. It is possible that he or she is naming friends or people he or she knows.

b. Again, the sample is not random. Because some letters occur more often, not everyone has the same chance of being selected.

c. No, the sample is not random. Only the eldest students have an opportunity of being selected.

d. Yes, names drawn at random from a hat do form a random sample.

e. No, this is not a random sample. Latecomers do not have an opportunity to be selected.

27. a. Let the population be the students and staff in your school. Suppose this list includes 1500 people. Let the sample size be 20% of the population, or 300 people. List the population alphabetically. Determine a systematic sampling procedure.

$$k = \frac{1500}{300}$$
$$= 5$$

Choose a random number between 1 and 5. Begin with that person on the list, and then ask every 5th person after that. If you started with the second name, you would survey numbers 2, 7, 12, 17, and so on from your list.

b. If the sample is chosen only from staff and students, other stakeholders (such as parents) would not be represented in the results. A redefinition of the population to include parents and other interested groups would be appropriate. Stratified sampling to ensure representation of all those groups would yield more valuable information on which to base a decision than only obtaining the results of students and staff.

5. Textbook questions 1 to 22 of "Mental Math: Multiplying by Multiples of 9," p. 363

1. $19 \times 9 = 190 - 19$
$= 171$

2. $28 \times 9 = 280 - 28$
$= 252$

3. $55 \times 9 = 550 - 55$
$= 495$

4. $88 \times 9 = 880 - 88$
$= 792$

5. $110 \times 9 = 1100 - 110$
$= 990$

6. $125 \times 9 = 1250 - 125$
$= 1125$

7. $4.5 \times 9 = 45 - 4.5$
$= 40.5$

8. $2.6 \times 9 = 26 - 2.6$
$= 23.4$

9. $5.7 \times 9 = 57 - 5.7$
$= 51.3$

10. $13 \times 9 = 130 - 13$
$= 117$

$\therefore\ 13 \times 90 = 1170$

11. $27 \times 9 = 270 - 27$
$= 243$

$\therefore\ 27 \times 90 = 2430$

12. $41 \times 9 = 410 - 41$
$= 369$

$\therefore\ 41 \times 90 = 3690$

13. $15 \times 9 = 150 - 15$
$= 135$

$\therefore\ 15 \times 900 = 13\,500$

14. $37 \times 9 = 370 - 37$
$= 333$

$\therefore\ 37 \times 900 = 33\,300$

15. $35 \times 9 = 350 - 35$
$= 315$

$\therefore\ 35 \times 900 = 31\,500$

16. $4.9 \times 9 = 49 - 4.9$
$= 44.1$

$\therefore\ 4.9 \times 90 = 441$

17. $6.4 \times 9 = 64 - 6.4$
$= 57.6$

$\therefore\ 6.4 \times 90 = 576$

18. $10.5 \times 9 = 105 - 10.5$
$= 94.5$

$\therefore\ 10.5 \times 90 = 945$

19. $16 \times 9 = 160 - 16$
$= 144$

$\therefore\ 16 \times 0.9 = 14.4$

20. $38 \times 9 = 380 - 38$
$= 342$

$\therefore\ 38 \times 0.9 = 34.2$

21. $42 \times 9 = 420 - 42$
$= 378$

$\therefore\ 42 \times 0.9 = 37.8$

22. The rule for multiplying by 9 works because $9 = 10 - 1$.

Look at the following for proof:

LS	RS
$9x$	$(10-1)x$
	$= 10x - x$
	$= 9x$

LS = RS

LS	RS
27×9	$27(10-1)$
$= 243$	$= 270 - 27$
	$= 243$

LS = RS

Section 1: Activity 2

1. a. Textbook questions a. to d. of "Explore: Analyze the Questions," p. 370

a. The response being encouraged is, "Yes, commercials are a small price to pay for being able to listen to the radio for free."

b. Because, in the first sentence, the person being interviewed is told that in-line skaters are a danger to pedestrians, the question encourages the response, "No, in-line skaters should not be allowed to skate on sidewalks."

c. The introduction states that Shakespeare's plays are old and not easily understood. Thus, the respondents are encouraged to say, "No, high school students should not be required to study one of Shakespeare's plays."

d. The word "really" encourages the response, "No, I don't think fast food is nutritious."

b. Textbook questions 1 to 4 of "Inquire," p. 370

1. The introductory sentence in each case influences the response.

In question a., the respondent is told commercials support private broadcasting, without them there would be no private radio stations.

In question b., the respondent is told that in-line skaters endanger pedestrians on sidewalks.

In question c., Shakespeare's plays are described as old and hard to understand.

2. In questions a. to c., the first sentence in each case should be eliminated to make the question fair, thus allowing for an unbiased response.

3. The phrase "Do you really think…" implies that no one in his or her right mind would say that fast food is nutritious.

4. Take out the word "really." Simply ask, "Do you think fast food is nutritious?"

2. a. Textbook questions 1 to 6 of "Practice," p. 372

1. Selection bias will influence this survey because pedestrians and motorists are likely to disagree on the issue of traffic volume.

2. Non-response bias will likely affect the results of this survey. Many people will ignore questionnaires placed on a counter. Only those with strong feelings are likely to reply.

3. Response bias will influence this survey. By immediately asking "In what subjects?", the respondent will likely answer, "Yes, there should be national examinations for all grade 10 students."

4. Selection bias will influence the results of this survey. Workers are likely to hold different views from the unemployed about government welfare.

5. Response bias will likely affect this survey. By having the word "really" in the opening phrase, it begs the response, "No, it is not fair!"

6. Selection bias will affect this survey. If the department store is an exclusive store catering to the well-to-do shopper, the response may well be, "Yes, I prefer air transportation."

b. Textbook questions 7 to 13 of "Practice," p. 372

7. Answers may vary. A sample answer is given.

   Which tastes better, Cola A or Cola B?

8. Answers may vary. A sample answer is given.

   Do small dogs make good pets?

9. Answers may vary. A sample answer is given.

   Should logging be restricted in Canada?

10. Answers may vary. A sample answer is given.

    How can you tell if a particular painting is considered art?

11. Answers may vary. A sample answer is given.

    What kind of projects make school work more interesting?

12. Answers may vary. A sample answer is given.

    Which is less damaging to the environment, hydro-electric power or nuclear power?

13. Answers may vary. A sample answer is given.

    What is Canada's favourite winter sport?

c. Textbook questions 14, 17, 21, and 22 of "Applications and Problem Solving," pp. 372 to 373

14. **a.** The organizations that would be interested in determining students' reasons for dropping out and then returning to school include departments of education, school boards, teachers' organizations, post-secondary institutions, and parents.

Section 1: Activity 2 (continued)

b. Answers may vary. Both probability and non-probability sampling techniques may be used in this survey. Non-probability sampling techniques may include convenience sampling or the sampling of volunteers.

c. Answers may vary. The questionnaire could contain both forced-response questions and open-ended questions. In the forced-response questions, the respondents would choose among reasons listed. The open-ended questions would allow the respondents to provide their own reasons for returning to school.

d. A follow-up survey might attempt to discover the success rate for returnees to school in finding employment after graduation.

17. Sources of bias could include both selection and non-response bias. Not all viewpoints would be represented in the poll. Only respondents with strongly-held views are likely to phone in, and there is nothing to prevent individuals from calling in more than once.

21. a. Yes, response bias can be present in a census of a population. The questions may be worded to elicit particular points of view or responses.

b. No, selection bias is not possible, since the entire population is surveyed in a census.

c. Yes, non-response bias is possible. Individuals may refuse to provide information to questions they feel are intrusive.

22. a. The accuracy of the data depends on the number of doctors surveyed. The larger the sample, the more reliable the results are. If only four doctors were surveyed, the results would be suspect.

A clustered sample of doctors would be an appropriate sampling technique. Doctors who prescribe and/or take headache tablets should comprise those sampled.

If questions do not include all headache tablets, the results of the survey will be biased in favour of those mentioned.

b. The company hopes that the public will conclude that 75% of doctors prefer their product.

3. Textbook questions 1 to 3 of "PATTERN POWER," p. 373

1. a.

	$1 \times 1 \times 1$ cubes	$2 \times 2 \times 2$ cubes	$3 \times 3 \times 3$ cubes	Total
Number of Cubes	27	8	1	36

b.

	$1\times1\times1$ cubes	$2\times2\times2$ cubes	$3\times3\times3$ cubes	$4\times4\times4$ cubes	Total
Number of Cubes	64	27	8	1	100

2. For an $n\times n\times n$ cube, the total number of cubes is $\left[\frac{n(n+1)}{2}\right]^2$.

3. a. For a $5\times5\times5$ cube, there are a total of

$$\left[\frac{5(5+1)}{2}\right]^2 = \left[\frac{5(6)}{2}\right]^2$$
$$= 15^2$$
$$= 225 \text{ cubes}$$

b. For a $6\times6\times6$ cube, there are a total of

$$\left[\frac{6(6+1)}{2}\right]^2 = \left[\frac{6(7)}{2}\right]^2$$
$$= 21^2$$
$$= 441 \text{ cubes}$$

Questions 3.a. and 3.b. can also be summarized using a table.

Number of Each Dimension of Cube	Diagram 5	Diagram 6
$1\times1\times1$ cubes	125	216
$2\times2\times2$ cubes	64	125
$3\times3\times3$ cubes	27	64
$4\times4\times4$ cubes	8	27
$5\times5\times5$ cubes	1	8
$6\times6\times6$ cubes	0	1
Total	$225 = 15^2$	$441 = 21^2$

Section 1: Follow-up Activities

Extra Help

Textbook questions 1 to 11 of "Review," p. 394

1. Answers may vary. Sample answers are given.

a. The population consists of all the students in your school. Stratified sampling by grade or sex could return meaningful results.

b. The population is all the households in your city or town. Random sampling or cluster sampling would obtain the desired results.

c. The population consists of all amateur musicians. Random sampling would return the desired results.

2. The population is all the students in the school. Suppose there are 900 students. Let the sample size be 10% of the population.

10% of 900 = 90

The simple random sampling might include the following steps:

Step 1: Assign each student a different number from 1 to 900.

Step 2: Select 90 students at random using a calculator or computer.

Step 3: Ask each sampled student the question and record the answer.

3. The population is all the high school students in your city or town. Suppose there are 10 000 students. Let the sample size be 10% of the population.

10% of 10 000 = 1000

The systematic sampling might include the following steps:

Step 1: Determine the sampling interval, k.

$$k = \frac{10\,000}{1000}$$
$$= 10$$

Step 2: Obtain an alphabetical list of students with telephone numbers from each high school.

Step 3: Choose a random number, x, from 1 to 10 to be the starting point of the systematic sample. If $x = 6$, start with the 6th student.

Step 4: Starting with the 6th student, telephone every 10th student. For example, telephone the students numbered 6, 16, 26, and so on.

Step 5: Ask each sampled student the question and record the answer.

4. The population is all the residents of your province. Suppose there are 1 000 000 residents. Let the sample size be 0.01% of the population.

0.01% of 1 000 000 = 100

The stratified sampling might include the following steps:

Step 1: Divide the population into two groups: male and female.

Step 2: Survey 50 males and 50 females with a random telephone survey.

Step 3: Ask each sampled resident the question and record the answer.

5. A researcher could stand on a street corner and ask passers-by the question, "Has Earth been visited by beings from outer space?"

6. This survey exhibits both a non-response bias by those who do not sign the petition and a selection bias in choosing variety stores.

7. The first sentence stating that teenagers drive too fast biases the results. This is an example of response bias.

8. A mail-in survey has non-response bias built in because a number of the people sent the questionnaire may not reply.

9. **a.** The population is the people that are home during the day.

b. The survey design exhibits a selection bias by excluding those who are not at home during the day. Many people, for example, would listen at work.

c. A systematic sampling of individuals at various locations, times of day, and months of the year would produce more meaningful results and reduce bias.

Extra Help (continued)

10. a. The population is all the students in the school. Suppose there are 740 students. Let the sample size be 15% of the population.

15% of 740 = 111

Stratified sampling might include the following steps:

Step 1: Divide the population into two groups: male and female.

Step 2: Survey 15% of the males and 15% of the females. If the school's population includes 380 females and 360 males,

$$n_f = 0.15 \times 380 \qquad n_m = 0.15 \times 360$$
$$= 57 \qquad = 54$$

Step 3: From the list of all students, prepare an alphabetical list of female students and an alphabetical list of male students.

Step 4: Use simple random sampling to identify 57 females and 54 males.

Step 5: Ask each of the 111 students to fill in a questionnaire; then record their answers.

b. The population would be the students in your school.

c. The questionnaire could include the following questions:

- Where do you do most of your studying? At home? At school? In the library?
- How many hours per night do you spend on your homework?
- How regularly do you conduct reviews?
- How often do you study with a friend?

d. Non-response bias occurs when people do not fill in the questionnaire. Students could be offered some incentive for responding to the question.

e. Stratification by school is an appropriate sampling technique.

11. a. The inference that the soft-drink company wants the public to draw is that their cola is better.

b. The results of the survey are not necessarily reliable. Without knowledge of the survey techniques, bias cannot be ruled out.

Enrichment

1. To randomly select 10 students from a class of 20 students, you could use the following procedure:

   Step 1: List the students alphabetically.

   Step 2: Number the students on your list.

   Step 3: Generate 10 random numbers between 1 and 20 using your graphing calculator. Press the following:

   MATH [Select the PRB menu.] 5 1 , 2 0 , 1 0) ENTER

   Suppose you obtained the following random numbers:

   18, 8, 3, 10, 20, 14, 11, 13, 19, 2

   Step 4: Survey students numbered 2, 3, 8, 10, 11, 13, 14, 18, 19, and 20 on your list.

2. **Textbook questions 1 to 3 of Investigation 3, "Sampling," p. 377**

   1. **a.** To generate random integers, in this case 60, between 1 and 750 inclusive on your graphing calculator, press the following:

      MATH [Select the PRB menu.] 5 1 , 7 5 0 , 6 0) ENTER

      b. If the same integer were generated twice, simply generate another random integer.

   2. Begin by alphabetically listing the females and males separately. To obtain 23 male students, generate 23 random integers between 1 and 460. On your graphing calculator, press the following:

      MATH [Select the PRB menu.] 5 1 , 4 6 0 , 2 3) ENTER

      Select the 23 male students so numbered for your survey.

      To select 21 female students, generate 21 random integers between 1 and 420. On your graphing calculator, press the following:

      MATH [Select the PRB menu.] 5 1 , 4 2 0 , 2 1) ENTER

      Select the 21 female students so numbered for your survey.

Enrichment (continued)

3. To select 67 students for your sample from a population of 670, select $\frac{67}{670} = 10\%$ of the students from each grade.

Grade 10: 10% of 250 students = 25 students
Grade 11: 10% of 220 students = 22 students
Grade 12: 10% of 200 students = 20 students
Total Sample = 67 students

List the students alphabetically by grade. Number the students in each list. Then use your graphing calculator to generate random integers to decide which students in each list will be surveyed.

For example, to select 25 grade 10 students, press the following:

MATH [Select the PRB menu.] 5 1 , 2 5 0 , 2 5)
ENTER

Use the random integers to make your selection.

3. Answers may vary. A sample spreadsheet is given.

A1 | x | √ | =RAND(500)

	A	B	C	D	E
1	132	329	294	212	478
2	61	64	202	234	54
3	79	316	273	191	354
4	105	324	158	360	359
5	43	462	384	253	322
6	439	262	194	316	173
7	243	211	270	463	96
8	119	33	40	16	47
9	301	154	185	29	158
10	310	239	164	382	497

Section 2: Activity 1

1. Textbook questions 1 to 5 of "Inquire," p. 54

1. a. $\dfrac{\text{GST}}{\text{Price}} = \dfrac{\$10\,010}{\$143\,000} \times 100\%$

$= 0.07 \times 100\%$

$= 7\%$

The rate of GST is 7%.

b. Multiply the price by 7%.

c. $\text{GST} = 0.07P$

2. a. $\dfrac{\text{PST}}{\text{Price}} = \dfrac{\$15\,301}{\$143\,000} \times 100\%$

$= 0.107 \times 100\%$

$= 10.7\%$

b. $\text{PST} = 0.107P$

3. a. $\dfrac{\text{PST}}{P + \text{GST}} = \dfrac{\$15\,301}{\$143\,000 + \$10\,010} \times 100\%$

$= 0.10 \times 100\%$

$= 10\%$

b. $\text{PST} = 0.10(P + \text{GST})$

$= 0.10(P + 0.07P)$

$= 0.10(1.07P)$

$= 0.107P$

4. a.

Price	GST	PST	Total
$143 000	$10 010	$10 725	$163 735
$85 000	$5950	$6375	$97 325

b.

Price	GST	PST	Total
$143 000	$10 010	$11 475.75	$164 485.75
$85 000	$5950	$6821.25	$97 771.25

Section 2: Activity 1 (continued)

5. First, determine the amount of PST paid.

$$\begin{aligned}\text{PST} &= (P + \text{GST} + \text{PST}) - (P + \text{GST}) \\ &= \$165\,880 - (\$143\,000 + 0.07 \times \$143\,000) \\ &= \$165\,880 - \$153\,010 \\ &= \$12\,870\end{aligned}$$

Now, calculate the rate of PST.

$$\begin{aligned}\frac{\text{PST}}{P} &= \frac{\$12\,870}{\$143\,000} \times 100\% \\ &= 0.09 \times 100\% \\ &= 9\%\end{aligned}$$

The rate of PST is 9%.

2. Textbook questions 1 to 5 of "Practice," p. 57

1. $P = 5000$, $i = 7\% = 0.07$, and $n = 6$

$$\begin{aligned}\therefore A &= P(1+i)^n \\ &= 5000(1+0.07)^6 \\ &= 5000(1.07)^6 \\ &= 7503.65\end{aligned}$$

The amount of the investment is \$7503.65.

2. $P = 8000$

$$i = \frac{4\%}{2} \quad \leftarrow \text{annual rate}, \ \leftarrow \text{2 semi-annual periods in a year}$$
$$= 2\%$$
$$= 0.02$$

$$n = 5 \times 2 \quad \leftarrow \text{number of years}, \ \leftarrow \text{2 semi-annual periods in a year}$$
$$= 10$$

$$\begin{aligned}\therefore A &= P(1+i)^n \\ &= 8000(1+0.02)^{10} \\ &= 8000(1.02)^{10} \\ &= 9751.96\end{aligned}$$

The amount of the investment is \$9751.96.

3. $P = 20\,000$

$$i = \frac{12\%}{12} \quad \leftarrow \text{annual rate} \quad \leftarrow \text{number of months in a year}$$
$$= 1\%$$
$$= 0.01$$
$$n = 3 \times 12 \quad \leftarrow \text{number of years} \quad \leftarrow \text{number of months in a year}$$
$$= 36$$

$$\therefore A = P(1+i)^n$$
$$= 20\,000(1+0.01)^{36}$$
$$= 20\,000(1.01)^{36}$$
$$= 28\,615.38$$

The amount of the investment is \$28 615.38.

4. $P = 6000$

$$i = \frac{6\%}{12} \quad \leftarrow \text{annual rate} \quad \leftarrow \text{number of months in a year}$$
$$= 0.5\%$$
$$= 0.005$$
$$n = 2 \times 12 \quad \leftarrow \text{number of years} \quad \leftarrow \text{number of months in a year}$$
$$= 24$$

$$\therefore A = P(1+i)^n$$
$$= 6000(1+0.005)^{24}$$
$$= 6000(1.005)^{24}$$
$$= 6762.96$$

The amount of the investment is \$6762.96.

5. $\text{GST} = \text{Price} \times 7\%$
$= \$295.00 \times 0.07$
$= \$20.65$

$\text{PST} = \text{Price} \times 8\%$
$= \$295.00 \times 0.08$
$= \$23.60$

$\therefore$ Total Price $= \$295.00 + \$20.65 + \$23.60$
$= \$339.25$

The total price of the bicycle is \$339.25.

Section 2: Activity 1 (continued)

3. Textbook questions 9 to 12 and 15 to 17 of "Applications and Problem Solving," pp. 57 to 59

9. a. The rows are independent. The data in each row are independent of the data in every other row.

b. The total number of points, P, is found by adding goals, g, and assists, a.

$$P = g + a$$

c.

Player	Goals	Assists	Points
Gordie Howe	801	1049	1850
Marcel Dionne	731	1040	1771
Phil Esposito	717	873	1590
Stan Mikita	541	926	1467
Bryan Trottier	520	890	1410
John Bucyk	556	813	1369
Guy Lafleur	560	793	1353
Bobby Clarke	358	852	1210

d. $P = 2g + a$

e.

Player	Goals	Points for Goals	Assists	Total Points
Gordie Howe	801	1602	1049	2651
Marcel Dionne	731	1462	1040	2502
Phil Esposito	717	1434	873	2307
Stan Mikita	541	1082	926	2008
Bryan Trottier	520	1040	890	1930
John Bucyk	556	1112	813	1925
Guy Lafleur	560	1120	793	1913
Bobby Clarke	358	716	852	1568

f.

Player	Games Played	Points	Points Per Game
Marcel Dionne	1348	1771	1.314
Phil Esposito	1282	1590	1.240
Guy Lafleur	1126	1353	1.202
Bryan Trottier	1238	1410	1.139
Bobby Clarke	1144	1210	1.058
Stan Mikita	1394	1467	1.052
Gordie Howe	1767	1850	1.047
John Bucyk	1540	1369	0.889

10. a. Answers may vary. A sample answer is given.

Awarding 5 points for gold, 4 points for silver, and 3 points for bronze would rank New Zealand first.

Country	Gold	Silver	Bronze	Total Points
New Zealand	0	3	2	18
Canada	1	2	1	16
Australia	3	0	0	15
England	1	0	1	8
Wales	0	0	1	3

b. Answers may vary. A sample answer is given.

Awarding 3 points for gold, 2 points for silver, and 1 point for bronze would place Australia first.

Country	Gold	Silver	Bronze	Total Points
Australia	3	0	0	9
Canada	1	2	1	8
New Zealand	0	3	2	8
England	1	0	1	4
Wales	0	0	1	1

c. No combination of points awarded for gold, silver, and bronze would place Canada in the lead.

Section 2: Activity 1 (continued)

11. a. $$\frac{\text{Sales Tax}}{\text{Price}} = \frac{\$6.30}{\$90.00} \times 100\%$$
$$= 0.07 \times 100\%$$
$$= 7\%$$

The rate of sales tax is 7%.

b. $$\text{Exchange Rate} = \frac{\text{Total (US \$)}}{\text{Total (CDN \$)}}$$
$$= \frac{\text{US \$96.30}}{\text{CDN \$128.40}}$$
$$= \text{US \$0.75 / CDN \$1.00}$$

The rate of exchange was US $0.75/CDN $1.00.

c. $$\text{Sales Tax (US \$)} = 0.065 \times \text{US \$90.00}$$
$$= \text{US \$5.85}$$

$$\therefore \text{Total (US \$)} = \text{Price (US \$)} + \text{Sales Tax (US \$)}$$
$$= \$90.00 + \$5.85$$
$$= \$95.85$$

Convert the total to Canadian dollars.

$$\text{US \$0.78} = \text{CDN \$1.00}$$
$$\text{US \$1.00} = \frac{\text{CDN \$1.00}}{0.78}$$

$$\therefore \text{US \$95.85} = \frac{\text{CDN \$1.00}}{0.78} \times 95.85$$
$$= \text{CDN \$122.88}$$

Price (US $)	Sales Tax (US $)	Total (US $)	Total (CDN $)
90	5.85	95.85	122.88

12. a. $P = 4000$, $i = 6\% = 0.06$, and $n = 4$

$$\begin{aligned}\therefore A &= P(1+i)^n \\ &= 4000(1+0.06)^4 \\ &= 4000(1.06)^4 \\ &= 5049.91\end{aligned}$$

Asha would have \$5049.91 at the end of 4 years.

b. At 6% for 2 years, Asha's bonds would be worth

$$\begin{aligned}A &= P(1+i)^n \\ &= 4000(1.06)^2\end{aligned}$$

If the interest rate is increased to 7% for the last 2 years, the total amount would be

$$\begin{aligned}A &= \underbrace{4000(1.06)^2}_{\text{total after 2 years}}(1.07)^2 \\ &= 5145.64\end{aligned}$$

Asha would have \$5145.64 at the end of 4 years.

c. At 7% for the first two years, followed by 6% for the last two years,

$$\begin{aligned}A &= \underbrace{4000(1.07)^2}_{\text{total after 2 years}}(1.06)^2 \\ &= 5145.64\end{aligned}$$

The two amounts are the same, since $4000(1.06)^2(1.07)^2 = 4000(1.07)^2(1.06)^2$.

15. a. $P = 1000$, $i = \dfrac{12\%}{2} = 0.06$, and $n = 2$

$$\begin{aligned}\therefore A &= P(1+i)^n \\ &= 1000(1+0.06)^2 \\ &= 1000(1.06)^2 \\ &= 1123.60\end{aligned}$$

Kyle had \$1123.60 at the end of the year.

Section 2: Activity 1 (continued)

b. $P = 1000$, $i = \dfrac{12\%}{4} = 0.03$, and $n = 4$

$$\begin{aligned}\therefore A &= P(1+i)^n \\ &= 1000(1+0.03)^4 \\ &= 1000(1.03)^4 \\ &= 1125.51\end{aligned}$$

Kyle had \$1125.51 at the end of the year.

c. Find the amount if the interest were compounded monthly.

$P = \$1000$, $i = \dfrac{12\%}{12} = 0.01$, and $n = 12$

$$\begin{aligned}\therefore A &= P(1+i)^n \\ &= 1000(1+0.01)^{12} \\ &= 1000(1.01)^{12} \\ &= 1126.83\end{aligned}$$

Find the amount if the interest were compounded daily.

$P = \$1000$, $i = \dfrac{12\%}{365} = \dfrac{0.12}{365}$, and $n = 365$

$$\begin{aligned}\therefore A &= P(1+i)^n \\ &= 1000\left(1+\frac{0.12}{365}\right)^{365} \\ &= 1127.47\end{aligned}$$

The amount where the interest is compounded daily is $\$1127.47 - \$1126.83 = \$0.64$ more than the amount where the interest is compounded monthly.

16. a. $$\frac{\text{Percent of World's Population in Asia}}{\text{Percent of World's Population in Europe}} = \frac{62.4}{9.6}$$
$$= 6.5$$

There are 6.5 times more people in Asia than in Europe.

b. $$\frac{\text{Area of Africa}}{\text{Area of South America}} = \frac{20.4}{12.0}$$
$$= 1.7$$

Africa is 1.7 times larger than South America.

c. The population density, d, can be defined as

$$d = \frac{\text{Percent of World's Population}}{\text{Percent of World's Land}}$$

The larger the value of d, the more people there are in a given area of land.

Continent	Percent of World's Population	Percent of World's Land	Density, d
Africa	13.2	20.4	0.6
Antarctica	0.0	8.9	0.0
Asia	62.4	30.0	2.1
Europe	9.6	7.1	1.4
North and Central America	8.4	16.3	0.5
Oceania	0.5	5.3	0.1
South America	5.9	12.0	0.5

Asia is the most crowded continent.

d. Just considering Asia, Europe, and North and Central America, over 80% of the world's population lives in the northern hemisphere.

e. Again, just considering Asia, Europe, and North and Central America, just over 53% of the world's land lies in the northern hemisphere.

f. From the results of d. and e., the northern hemisphere is more crowded.

Section 2: Activity 1 (continued)

17. a. The loan will be repaid in 1 year.

b. The amount that goes towards paying off the loan, L, can be expressed as follows:

- $L = M - I$, where M is the monthly payment and I is the interest charged
- $L = O - C$, where O is the opening balance and C is the closing balance

c. **Method 1**

$$\begin{aligned} L &= M - I \\ &= \$17\,305.35 - \$1072.52 \\ &= \$16\,232.83 \end{aligned}$$

Method 2

$$\begin{aligned} L &= O - C \\ &= \$183\,861.32 - \$167\,628.49 \\ &= \$16\,232.83 \end{aligned}$$

d. To the end of June, the total monthly payments are $\$17\,305.35 \times 6 = \$103\,832.10$.

e. $\$200\,000.00 - \$101\,744.73 = \$98\,255.27$

$98 255.27 of the first six payments goes toward the opening balance.

f. The additional amount to be paid at the end of December is the increase in interest for that month.

Interest at $7\% = \$100.36$ (from the table)

$$\begin{aligned} \text{Interest at } 9\% &= \frac{9\%}{12} \times \text{Opening balance in December} \\ &= \frac{0.09}{12} \times \$17\,204.97 \\ &= 129.04 \end{aligned}$$

If the payment stayed the same in December, then $\$129.04 - \$100.36 = \$28.68$ would be the amount still owing.

g. The monthly payments have been rounded to the nearest cent. To compensate for rounding, December's payment differs from the other monthly payments.

h. Let x represent the extra payment at the end of May. Thus, the outstanding balance at the beginning of June is $118\,359.65 - x$.

$$\text{Balance at the end of June} = (118\,359.65 - x)\left(1 + \frac{0.07}{12}\right) - 17\,305.35$$
$$= 101\,744.73 - \left(1 + \frac{0.07}{12}\right)x$$

$$\text{Balance at the end of July} = \left[101\,744.73 - \left(1 + \frac{0.07}{12}\right)x\right]\left(1 + \frac{0.07}{12}\right) - 17\,305.35$$
$$= 85\,032.89 - \left(1 + \frac{0.07}{12}\right)^2 x$$

$$\text{Balance at the end of August} = \left[85\,032.89 - \left(1 + \frac{0.07}{12}\right)^2 x\right]\left(1 + \frac{0.07}{12}\right) - 17\,305.35$$
$$= 68\,223.57 - \left(1 + \frac{0.07}{12}\right)^3 x$$

$$\text{Balance at the end of September} = \left[68\,223.57 - \left(1 + \frac{0.07}{12}\right)^3 x\right]\left(1 + \frac{0.07}{12}\right) - 17\,305.35$$
$$= 51\,316.19 - \left(1 + \frac{0.07}{12}\right)^4 x$$

$$\text{Balance at the end of October} = \left[51\,316.19 - \left(1 + \frac{0.07}{12}\right)^4 x\right]\left(1 + \frac{0.07}{12}\right) - 17\,305.35$$
$$= 34\,310.18 - \left(1 + \frac{0.07}{12}\right)^5 x$$

If the balance at the end of October is 0, then

$$\left(1 + \frac{0.07}{12}\right)^5 x = 34\,310.18$$
$$x = \frac{34\,310.18}{\left(1 + \frac{0.07}{12}\right)^5}$$
$$= 33\,326.74$$

An extra payment of \$33 326.74 at the end of May will pay off the loan at the end of October.

Section 2: Activity 1 (continued)

i. $\$34\,310.18 - \$33\,326.74 = \$983.44$

Paying the loan off at the end of October will require an extra $983.44.

j. An advantage is that less money is required to pay off the loan. A disadvantage might be that the extra payment could be earning interest at a rate greater than 7% in some other investment.

4. Textbook questions 1 to 4 of Investigation 1, "Patterns in Numbers and Letters," p. 52

1. a. Add 3 to each number.

4, 7, 10, 13, **16**, **19**, **22**

b. Multiply each number by 2.

3, 6, 12, 24, **48**, **96**, **192**

c. Begin by adding 1 to the first number, then 2 to the second number, then 3 to the third number, and so on.

1, 2, 4, 7, 11, 16, **22**, **29**, **37**

d. Alternate multiplying by 3 and dividing by 2.

4, 12, 6, 18, 9, **27**, **13.5**, **40.5**

e. Alternate adding 1 and multiplying by 3.

2, 3, 9, 10, 30, **31**, **93**, **94**

f. Each term is the sum of the previous two terms.

3, 4, 7, 11, 18, 29, **47**, **76**, **123**

g. Add 18 to each number.

9, 27, 45, 63, **81**, **99**, **117**

2. a. Write every third letter, starting with A.

A, D, G, J, **M**, **P**, **S**

b. The odd-numbered terms are consecutive letters starting with A. The even-numbered terms are consecutive letters starting with D.

A, D, B, E, C, F, D, **G**, **E**, **H**

c. Starting with A, alternate going forward 2 letters and going forward 1 letter.

A, C, D, F, G, I, J, **L**, **M**, **O**

d. The odd-numbered terms are numbers that form a sequence by adding 3 to the first number, then 4 to the second number, then 5 to the third number, and so on. The even-numbered terms are letters of the alphabet in reverse order.

1, Z, 4, Y, 8, X, **13**, **W**, **19**, **V**

3. a. The numbers in the upper-right corner form the sequence, 2, 7, 14, 23. This sequence is formed by adding 5 to the first number (2), adding 7 to the second number, adding 9 to the third number, and so on.

In each diagram, the number in the lower-left corner is 9 more than the number in the upper-right corner.

The numbers in the lower-right corner form the sequence 4, 9, 16, 25. This sequence can also be written as 2^2, 3^2, 4^2, 5^2. Notice that the sequence is consecutive squares starting at 2.
Note: This sequence can also be formed using the same method as for the sequence for the upper-right numbers.

In each diagram, the number in the upper-left corner is 3 times the number in the lower-right corner.

Therefore, the next two diagrams are as follows:

108	34
43	36

147	47
56	49

b.

3	0
3	2
2	8
3	1

3	4
3	6
3	2
3	5

The sequence is 14, 18, 22, 26, 30, 34.

The sequence is 16, 20, 24, 28, 32, 36.

The sequence is 12, 16, 20, 24, 28, 32.

The sequence is 15, 19, 23, 27, 31, 35.

Section 2: Activity 1 (continued)

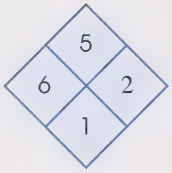
4. To find the pattern, divide the product of the horizontal numbers by the sum of the vertical numbers. The result is always 2.

$$\therefore \frac{(6\times ?)}{(5+1)} = 2$$

$$\frac{(6\times ?)}{6} = 2$$

$$6\times ? = 12$$

$$? = 2$$



Section 2: Activity 2

1. a. Textbook questions 1.b., 1.c., and 2 of Investigation 1, "Interest Calculated Annually," p. 86

1. b. The farmer may choose to keep the term of the loan the same and pay higher annual payments due to the increase in interest. The farmer might pay off the loan at the end of the fourth year or pay an additional amount towards the principal to minimize the effect of higher rates. Another option is to increase the term of the loan and keep the payments at or below the current level.

c. If interest rates fall, Claudia might renegotiate the loan to decrease her annual payments or choose to keep the payments at current levels and decrease the term of the loan.

2.

	A	B	C	D	E	F
1	Year	Opening Balance	Annual Interest	Interest	Annual Payment	Closing Balance
2	1	$80000.00	6.50%	$5200.00	$13138.98	$72061.02
3	2	$72061.02	6.50%	$4683.97	$13138.98	$63606.01
4	3	$63606.01	6.50%	$4134.39	$13138.98	$54601.42
5	4	$54601.42	6.50%	$3549.09	$13138.98	$45011.53
6	5	$45011.53	6.50%	$2925.75	$13138.98	$34798.30
7	6	$34798.30	6.50%	$2261.89	$13138.98	$23921.21
8	7	$23921.21	6.50%	$1554.88	$13138.98	$12337.11
9	8	$12337.11	6.50%	$801.91	$13139.02	$0.00

b. Textbook question from Investigation 2, "Interest Calculated Monthly," p. 86

	A	B	C	D	E	F
1	Month	Opening Balance	Annual Interest	Interest	Monthly Payment	Closing Balance
2	1	$10000.00	6.00%	$50.00	$860.66	$9189.34
3	2	$9189.34	6.00%	$45.95	$860.66	$8374.63
4	3	$8374.63	6.00%	$41.87	$860.66	$7555.84
5	4	$7555.84	6.00%	$37.78	$860.66	$6732.96
6	5	$6732.96	6.00%	$33.66	$860.66	$5905.96
7	6	$5905.96	6.00%	$29.53	$860.66	$5074.83
8	7	$5074.83	6.00%	$25.37	$860.66	$4239.55
9	8	$4239.55	6.00%	$21.20	$860.66	$3400.09
10	9	$3400.09	6.00%	$17.00	$860.66	$2556.43
11	10	$2556.43	6.00%	$12.78	$860.66	$1708.55
12	11	$1708.55	6.00%	$8.54	$860.66	$856.43
13	12	$856.43	6.00%	$4.28	$860.71	$0.00

2.

Cell	Formula
A9	1
A10	=A9+1
B9	=B5
C9	=B9*$B$4/12
D9	=B9+C9-$B$6

3.

	A	B	C
1	Consumer Loan with Monthly Payments		
2			
3	Number of Years	5	
4	Annual Rate	9.00%	
5	Principal	$80000.00	
6	Monthly Rate	$1660.67	

$$\begin{aligned}\text{Total Interest} &= \text{Total Payments} - \text{Principal}\\ &= \$1660.67 \times 60 - \$80\,000\\ &= \$99\,640.20 - \$80\,000\\ &= \$19\,640.20\end{aligned}$$

The total interest is $19 640.20.

Section 2: Activity 2 (continued)

4.

Cell	Formula
A7	1
B7	=B3
C7	=B7*$B$4
D7	=B7+C7
A8	=A7+1
B8	=D7

5.

	A	B	C	D
1	**Compound Interest**			
2				
3	**Principal**	$10000.00		
4	**Interest Rate Per Period**	4.50%		
5				
6	**Period**	**Principal**	**Interest**	**Amount**
7	1	$10000.00	$450.00	$10450.00
8	2	$10450.00	$470.25	$10920.25
9	3	$10920.25	$491.41	$11411.66
10	4	$11411.66	$513.52	$11925.19
11	5	$11925.19	$536.63	$12461.82
12	6	$12461.82	$560.78	$13022.60
13	7	$13022.60	$586.02	$13608.62
14	8	$13608.62	$612.39	$14221.01
15	9	$14221.01	$639.95	$14860.95
16	10	$14860.95	$668.74	$15529.69
17	11	$15529.69	$698.84	$16228.53
18	12	$16228.53	$730.28	$16958.81
19	13	$16958.81	$763.15	$17721.96
20	14	$17721.96	$797.49	$18519.45
21	15	$18519.45	$833.38	$19352.82
22	16	$19352.82	$870.88	$20223.70
23	17	$20223.70	$910.07	$21133.77
24	18	$21133.77	$951.02	$22084.79
25	19	$22084.79	$993.82	$23078.60
26	20	$23078.60	$1038.54	$24117.14

The total interest earned is $\$24\,117.14 - \$10\,000 = \$14\,117.14$.

6.

	A	B	C	D	E	F	G
1	Aim Point	Distance from Point A (km)	Sand Distance (km)	Sand Time (h)	Road Distance (km)	Road Time (h)	Total Time (h)
2	A	0	80	4	100	2.5	6.5
3	B	5	80.156097	4.00780	95	2.375	6.3828
4	C	10	80.622577	4.03112	90	2.25	6.2811
5	D	15	81.394102	4.06970	85	2.125	6.1947
6	E	20	82.462112	4.12310	80	2	6.1231
7	F	25	83.815273	4.19076	75	1.875	6.0657
8	G	30	85.440037	4.27200	70	1.75	6.0220
9	H	35	87.321245	4.36606	65	1.625	5.9910
10	I	40	89.442719	4.47213	60	1.5	5.9721
11	J	45	91.787798	4.58938	55	1.375	5.9643
12	K	50	94.339811	4.71699	50	1.25	5.9669
13	L	55	97.082439	4.85412	45	1.125	5.9791
14	M	60	100	5	40	1	6
15	N	65	103.07764	5.15388	35	0.875	6.0288
16	O	70	106.30145	5.31507	30	0.75	6.0650

According to the spreadsheet, the shortest travelling time is approximately 5.9643 h.

Section 2: Activity 3

1. Computer Data Bank questions 3 and 4 of "What Is a Database?"

3. The other 6 field names are Category, Year, Location, Winning Athlete, Winning Country, and Winning Time, s.

4. In the first record, the field value of the Winning Time, s field is 12.00.

Computer Data Bank questions 1 to 3 of "Moving Through Records"

1. Record 145 deals with the 100-m hurdles for women, in 1988, in Seoul.

2. Record 144 deals with the 100-m hurdles for women, in 1984, in Los Angeles.

3. The last record in this database deals with the 100-m butterfly for women, in 1996, in Atlanta.

Computer Data Bank question 2 of "Ways to Display Records"

2. Full Record may be used when you are most interested in all the fields of individual records. Table 1 or Table 2 may be used when you are most interested in the fields in that table over a number of records.

Section 2: Activity 3 (continued)

Computer Data Bank questions 1 and 3 of "Creating Tables"

1. The records are in full-record layout.

3. The full name of the second ski area is Beaver Valley Ski Club.

Computer Data Bank questions 3 and 4 of "Selecting Records"

3. The top left part of the screen, under the record book, tells you that 5 records are selected.

4. The top left part of the screen, under the record book, tells you that 6 records are selected.

Computer Data Bank question 2 of "Hiding Records"

2. The top left part of the screen, under the record book, tells you that 5 of 280 records are displayed and that 5 records are selected.

Computer Data Bank questions 1 and 2 of "Copying and Cutting Records"

1. Record 100 is The Shaggy Dog. The top left part of the screen, under the record book, tells you that 281 records are displayed.

2. The top left part of the screen, under the record book, tells you that 280 records are displayed.

Computer Data Bank questions 3 to 7 of "Using the Find Feature"

3. Seventy-nine of 116 records are displayed now.

4. Six of 116 records are displayed now.

5. Fifty-nine of 116 records are displayed now.

6. One hundred and eleven of 116 records are displayed now.

7. Ninety-two of 116 records are displayed now.

Computer Data Bank questions 2 to 4 of "Sorting Records"

2. Swiss cheese has the greatest amount of calcium in a serving.

3. The first type is Beverage. Among the beverages, tomato juice has the greatest amount of iron in a serving.

4. Coffee appears first.

Computer Data Bank questions 1 and 2 of "Matching Records"

1. Three hundred and forty-seven of 428 records are displayed now.

2. Thirty-nine of 428 records are displayed now.

Computer Data Bank question 6 of "Adding Calculation Fields"

6. A total of 5 movies lost money. This can be found using one of two methods:

   Method 1

   Sort the profits from least to greatest. Find the number with negative profits.

   Method 2

   Sort costs as a percent of income from greatest to least. Find those movies for which this percent is greater than 100.

2. Ranked from greatest to least, the groups with the top 3 claim frequencies are as follows:

Gender	Age	Claim Frequency, % of Vehicles
Female	46–55	24.8
Male	23–24	21.9
Male	46–55	18.8

3. Ranked from greatest to least, the groups with the top 3 claim amounts are as follows:

Gender	Age	Cost Per Claim, $
Male	15–18	4314
Male	21–22	4047
Female	21–22	3532

4. Ranked from greatest to least, the groups with the top 3 expected claim amounts per insured vehicle are as follows:

Gender	Age	Expected Claim Per Insured Vehicle, $
Male	23–24	686
Female	46–55	582
Male	15–18	496

Section 2: Activity 3 (continued)

5. a. Textbook questions 1 to 4 of Investigation 1; "Favourite Type of Movie," p. 62

1. Answers may vary. A sample answer is given.

There are records for 45 action movies.

2. There are 3 action movies with a 4-star rating.

$$\% \text{ of records} = \frac{3}{45} \times 100\%$$
$$\doteq 6.7\%$$

3.

Type	Number of Records	Number with a 4-Star Rating	% with a 4-Star Rating
Action	45	3	6.7
Comedy	67	8	11.9
Drama	90	28	31.1
Family	25	2	8.0
Horror	3	1	33.3
Musical	31	10	32.3
Science Fiction	11	5	45.5
Western	8	3	37.5

4. Science-fiction movies have the greatest percent of 4-star ratings.

Action movies have the least percent of 4-star ratings.

Not everyone would have predicted these results. Many people may predict that family movies would have the highest percentage of 4-star ratings.

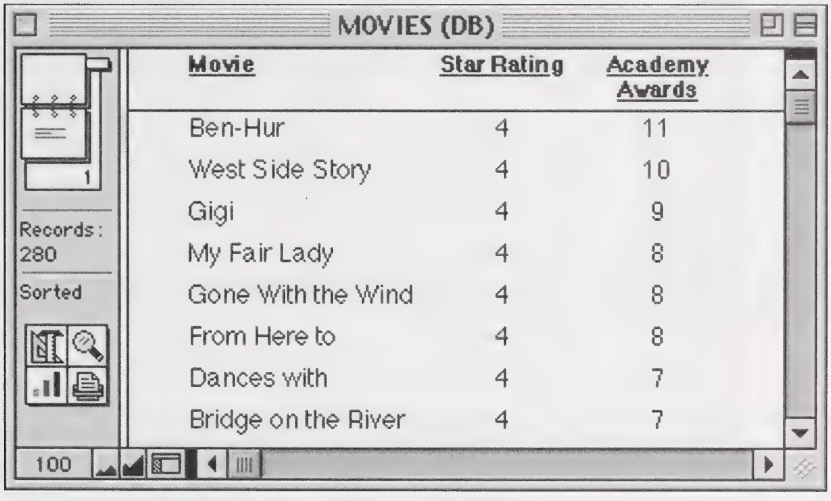
b. Textbook questions 1 to 3 of Investigation 2, "Academy Awards," p. 62

1. From the Layout menu, select "New Layout." Click the Columnar report radial button and click "OK." Select and move the following fields from Field List to Field Order:

Movie Star Rating Academy Awards

Click "OK"; then select "Browse" from the Layout menu to view the table.

2. To sort the records, select "Sort Records" from the Organise menu. Select and move "Star Rating" and "Academy Awards" from the Field List to Sort Order. Make sure the Descending order radial button is selected for both in order to get a list from greatest to least. Click "OK."



The 4-star movie with the highest number of Academy Awards is Ben-Hur with 11.

3. Generally, the movies with higher star ratings have more Academy Awards. Movies that reviewers feel are best are normally the ones the Academy selects for its awards.

Section 2: Activity 3 (continued)

c. Textbook questions 1 to 6 of Investigation 3, "Comparing Profits," p. 62

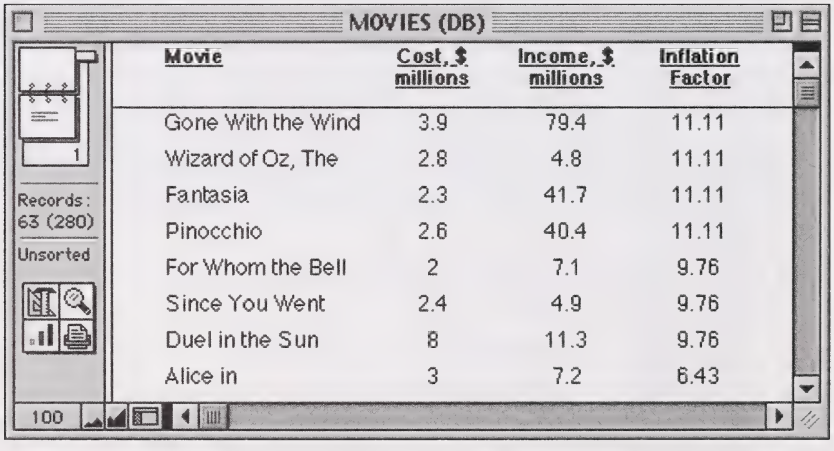
1. First, find all the records for which "Cost, $ Millions" is available by doing the following:

- Open the Movies database.
- From the Layout menu, select "Find."
- Enter "< > -1" in the Cost, $ Millions box.
- Click "Find."

Now, create a table displaying the fields "Movie," "Cost, $ Millions," "Income, $ Millions," and "Inflation Factor" by doing the following:

- From the Layout menu, select "New Layout."
- Select the Columnar report radial button.
- Select and move the four fields to be included in the table.
- Click "OK."

Lay out the table so that the fields and the field values can be easily read. Select "Browse" in order to view the new table.



Movie	Cost, $ millions	Income, $ millions	Inflation Factor
Gone With the Wind	3.9	79.4	11.11
Wizard of Oz, The	2.8	4.8	11.11
Fantasia	2.3	41.7	11.11
Pinocchio	2.6	40.4	11.11
For Whom the Bell	2	7.1	9.76
Since You Went	2.4	4.9	9.76
Duel in the Sun	8	11.3	9.76
Alice in	3	7.2	6.43

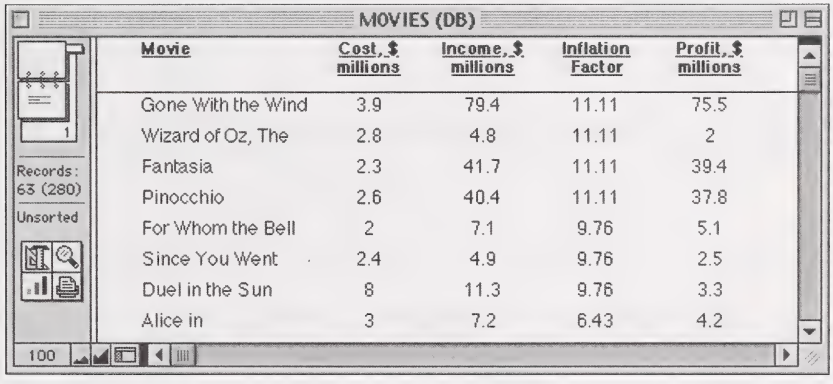
2. To calculate profit in millions of dollars, use the formula

$$\text{Profit, \$ millions} = \text{Income, \$ millions} - \text{Cost, \$ millions}$$

To add a calculation field called Profit, $ millions do the following:

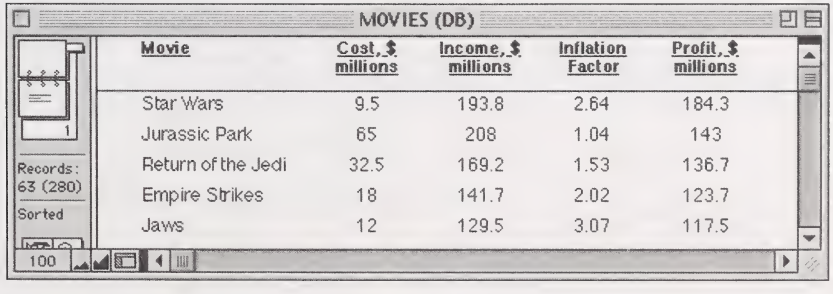
- From the Layout menu, select "Define Fields."
- Enter the field name, "Profit, $ millions."
- Click ▼ at Field Type and select "Calculation."
- Click "Create."
- Enter the formula by selecting the field name "Income, $ millions," the operator "–," and the field name "Cost, $ millions."
- Click "OK."
- Click "Done."

Lay out the table so that the fields and the field values can be easily read.



Movie	Cost, $ millions	Income, $ millions	Inflation Factor	Profit, $ millions
Gone With the Wind	3.9	79.4	11.11	75.5
Wizard of Oz, The	2.8	4.8	11.11	2
Fantasia	2.3	41.7	11.11	39.4
Pinocchio	2.6	40.4	11.11	37.8
For Whom the Bell	2	7.1	9.76	5.1
Since You Went	2.4	4.9	9.76	2.5
Duel in the Sun	8	11.3	9.76	3.3
Alice in	3	7.2	6.43	4.2

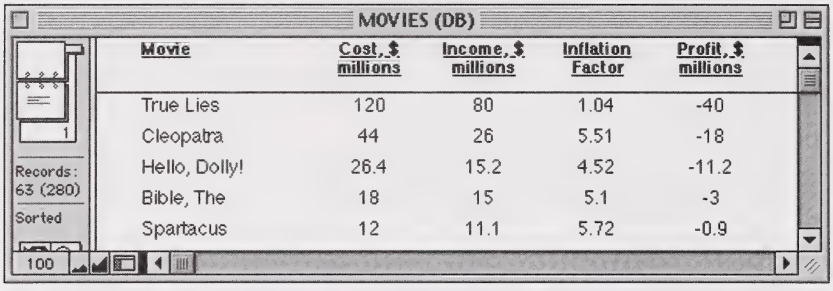
3. The following table displays the top 5 movies sorted by Profit, $ millions:



Movie	Cost, $ millions	Income, $ millions	Inflation Factor	Profit, $ millions
Star Wars	9.5	193.8	2.64	184.3
Jurassic Park	65	208	1.04	143
Return of the Jedi	32.5	169.2	1.53	136.7
Empire Strikes	18	141.7	2.02	123.7
Jaws	12	129.5	3.07	117.5

Section 2: Activity 3 (continued)

4. The movies that lost money are those that show a negative profit. There are five movies that lost money. Look at the following table:



Movie	Cost, $ millions	Income, $ millions	Inflation Factor	Profit, $ millions
True Lies	120	80	1.04	-40
Cleopatra	44	26	5.51	-18
Hello, Dolly!	26.4	15.2	4.52	-11.2
Bible, The	18	15	5.1	-3
Spartacus	12	11.1	5.72	-0.9

5. To create a calculation field called "Profit, 1996 $ millions," rounded to 1 decimal place, do the following:

   - From the Layout menu, select "Define Fields."
   - Enter "Profit, 1996 $ millions" in the Field Name box.
   - Click ▼ in Field Type and select "Calculation."
   - Click "Create."
   - Select "ROUND(number, number of digits)" from the Function list.
   - For the first value in the parentheses ("number"), select "Inflation Factor" from the Fields list, the operator "*," and "Profit, $ millions" from the Fields list.

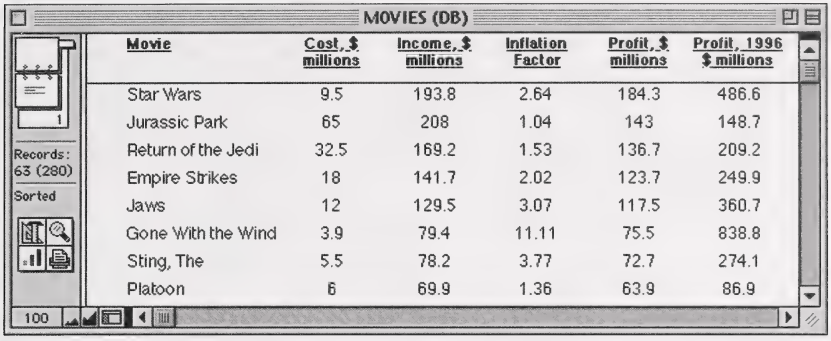
     For the second value in the parentheses ("number of digits"), enter "1" in order to round all values in this new field to 1 decimal place.

     Formula

     ```
     ROUND('Inflation Factor'*'Profit, $ millions',1)
     ```

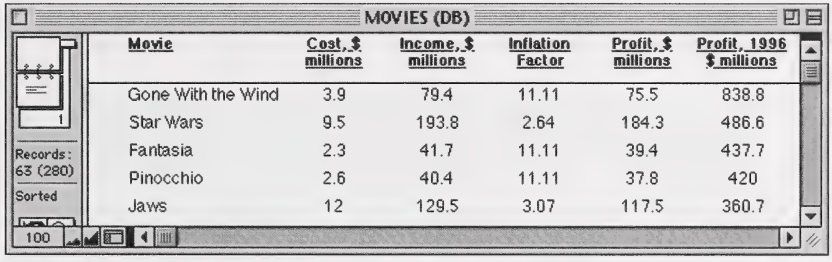
   - Click "OK."
   - Click "Done."

Lay out the table so that the fields and the field values can easily be read.



Movie	Cost, $ millions	Income, $ millions	Inflation Factor	Profit, $ millions	Profit, 1996 $ millions
Star Wars	9.5	193.8	2.64	184.3	486.6
Jurassic Park	65	208	1.04	143	148.7
Return of the Jedi	32.5	169.2	1.53	136.7	209.2
Empire Strikes	18	141.7	2.02	123.7	249.9
Jaws	12	129.5	3.07	117.5	360.7
Gone With the Wind	3.9	79.4	11.11	75.5	838.8
Sting, The	5.5	78.2	3.77	72.7	274.1
Platoon	6	69.9	1.36	63.9	86.9

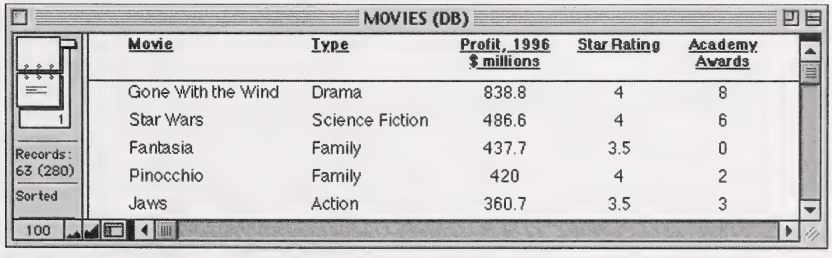
6. The following table displays the top five movies sorted by Profit, 1996 $ millions.



Movie	Cost, $ millions	Income, $ millions	Inflation Factor	Profit, $ millions	Profit, 1996 $ millions
Gone With the Wind	3.9	79.4	11.11	75.5	838.8
Star Wars	9.5	193.8	2.64	184.3	486.6
Fantasia	2.3	41.7	11.11	39.4	437.7
Pinocchio	2.6	40.4	11.11	37.8	420
Jaws	12	129.5	3.07	117.5	360.7

d. Textbook question 1 of Investigation 4, "Making Movies," p. 62

1. The table, sorted by profit, star rating, and Academy Awards, lists *Gone with the Wind* (a drama) as the top movie. Movie producers trying to duplicate this formula would produce dramas.



Movie	Type	Profit, 1996 $ millions	Star Rating	Academy Awards
Gone With the Wind	Drama	838.8	4	8
Star Wars	Science Fiction	486.6	4	6
Fantasia	Family	437.7	3.5	0
Pinocchio	Family	420	4	2
Jaws	Action	360.7	3.5	3

6. Textbook questions 1 to 6 of "Measuring Readability," p. 87

Answers to questions 1 to 6 will vary. Sample answers are given.

1. The selection chosen is the introduction to Chapter 1 on page 1 of *MATHPOWER™ 10.*

Section 2: Activity 3 (continued)

2. Number of syllables = 161

$$\text{Average number of syllables / word} = \frac{161}{100}$$
$$= 1.61$$

3. $$\text{Number of sentences} = 6 + \frac{4}{22}$$
$$\doteq 6.18$$

4. $$\frac{100}{6.18} \doteq 16.18$$

On average, there are about 16.18 words/sentence.

5. The two additional selections are the Chapter 2 and Chapter 3 introductions.

Selection	Number of Syllables/Word	Number of Words/Sentence
1	1.61	16.18
2	1.36	17.70
3	1.74	12.80
Average	1.57	15.56

6. $$\text{Grade Level} \doteq 0.39 \times 15.56 + 11.8 \times 1.57 - 15.59$$
$$\doteq 9.00$$

Section 2: Follow-up Activities

Extra Help

1. Yes, the results of one row are used to calculate the next row. In particular, the lengths of the sides of the squares increase by 0.5 from row to row. The formula for the volume of the box is defined the same way from row to row.

2. B5 = 30-2*A5
C5 = A5
D5 = B5^2*C5
A6 = A5+0.5

3.

	A	B	C	D
1	**Volume of the Box**			
2				
3	**Length of Side of Square**	**Length of Side of Base of Box, 30-2x**	**Height, x**	**Volume**
4	4.5	21	4.5	1984.5
5	4.6	20.8	4.6	1990.144
6	4.7	20.6	4.7	1994.492
7	4.8	20.4	4.8	1997.568
8	4.9	20.2	4.9	1999.396
9	5	20	5	2000
10	5.1	19.8	5.1	1999.404
11	5.2	19.6	5.2	1997.632
12	5.3	19.4	5.3	1994.708
13	5.4	19.2	5.4	1990.656
14	5.5	19	5.5	1985.5
15	5.6	18.8	5.6	1979.264
16	5.7	18.6	5.7	1971.972
17	5.8	18.4	5.8	1963.648

4. There might have been a value between $x = 4.5$ cm and $x = 5.5$ cm other than $x = 5.0$ for which a maximum volume could have occurred.

Enrichment

1. The monthly payment is $210.12.

2. The monthly payment is $862.67.

$$\therefore \text{ Total payment} = \$862.67 \times 12 \times 30$$
$$= \$310\,561.20$$

3. $$\text{Pmt} = \frac{P\left[\left(1+\frac{i}{2}\right)^{\frac{1}{6}} - 1\right]}{1-\left[\left(1+\frac{i}{2}\right)^{\frac{1}{6}}\right]^{-12n}}$$

Computer Data Bank for Macintosh

System and Software Requirements

To use the *ClarisWorks*™ for Macintosh databases in *MATHPOWER*™ *10, Western Edition, Computer Data Bank*, you need

- a Mac OS compatible computer with a 68020 processor or higher, running System 7.0 or higher
- hard disk drive and at least 4 MB of RAM
- a 3.5-inch high-density floppy disk drive
- *ClarisWorks*™ 4.0 or higher installed on your hard drive
- Arial, Helvetica, and Palatino fonts installed on your hard drive

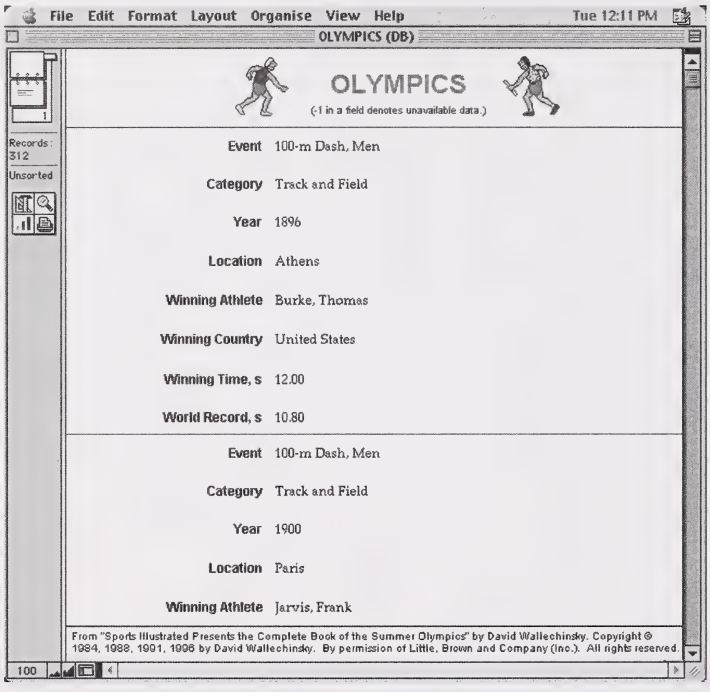
Exploring Databases

What Is a Database?

1. Open the Olympics database from the *MATHPOWER DATA BANK* folder.

To **enlarge a window to full size**, click the zoom box near the right end of the window's title bar.

2. Enlarge the window.


File Edit Format Layout Organise View Help
Tue 12:11 PM
OLYMPICS (DB)
OLYMPICS
(-1 in a field denotes unavailable data.)
Records: 312
Unsorted
Event 100-m Dash, Men
Category Track and Field
Year 1896
Location Athens
Winning Athlete Burke, Thomas
Winning Country United States
Winning Time, s 12.00
World Record, s 10.80
Event 100-m Dash, Men
Category Track and Field
Year 1900
Location Paris
Winning Athlete Jarvis, Frank
From "Sports Illustrated Presents the Complete Book of the Summer Olympics" by David Wallechinsky. Copyright © 1984, 1988, 1991, 1996 by David Wallechinsky. By permission of Little, Brown and Company (Inc.). All rights reserved.
100

A **database** is a collection of related information that you can reorganize in order to interpret and analyse the information.

A database consists of sets of **records**. Each record is a set of **fields**. The **field names** are on the left and the **field values** are to the right. The first record is about the 100-m dash for men, in 1896, in Athens.

The first field name in each record is "Event." The last field name in each record is "World Record, s." There are 8 fields in all.

3. What are the other 6 field names?

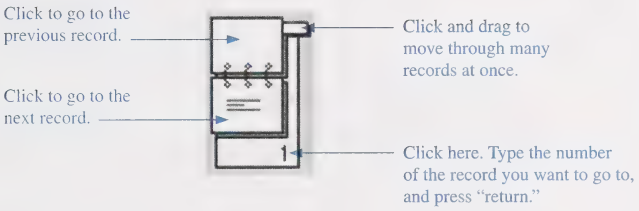
The Event field value is "100-m Dash, Men" in the first record.

4. What is the field value of the Winning Time, s field in the first record?

Moving Through Records

To **move through records**, use any of the following:

- the scroll bar on the right
- the record book on the left near the top


Click to go to the previous record.
Click to go to the next record.
Click and drag to move through many records at once.
1
Click here. Type the number of the record you want to go to, and press "return."

Just below the record book, you are told that there are 312 records in this database and they are unsorted.

1. Move to record 145. What is it about?

2. Move to the record just before record 145. What is it about?

3. What is the last record in this database about?

4. Move back to the first record.

Ways to Display Records

The databases have been set up to display full records, one after the other (as you have been looking at them), and in tables with the field names as headers and the field values in columns below the headers.

1. Click on the Layout menu and observe the ✓ in front of "Full Record."

The ✓ tells you that Full Record is being displayed. Below Full Record are "Table 1" and "Table 2." More than one table is needed to show all the fields. You can also create your own tables. You will do this later.

To **change how the records are displayed**, click on the Layout menu and select "Full Record," "Table 1," or "Table 2" (or an alternative when it has been created).

2. Display the records all three ways. When might you use each way?

3. Close the database.

Making Tables and Saving Changes

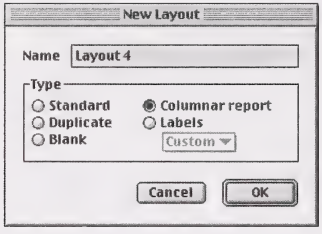
Creating Tables

Sometimes you are interested only in certain fields. You can create a table to display only those fields.

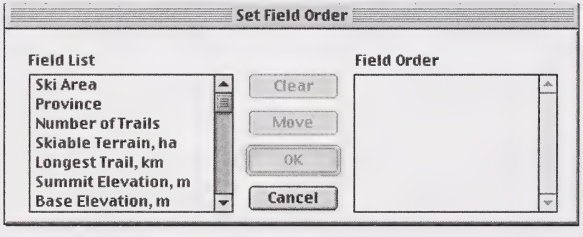
1. Open the Skiing database. Are the records in full-record layout or in a table layout?

To **create a table** that will display only certain fields from existing records, do the following:

- Click on the Layout menu and select "New Layout." The following window appears:



- Enter a name or use the one given; click on the Columnar report radial button; and click "OK." The following window appears:



- Click the field name you want first in the table; then click "Move."
- Click the field name you want second; then click "Move."
- Continue until you have all the field names you want moved; then click "OK."

2. Create a table to display only these fields in this order:

Ski Area Number of Trails Longest Trail, km

Sometimes a field value is not fully visible.

To **see all of a field value**, click on the field value.

3. Click to see the full name of the second ski area. What is it?

To **change how the records are displayed**, click on the Layout menu and select "Full Record," "Table 1," or "Table 2" (or an alternative when it has been created).

4. Display the records using Full Record. Then, display them using the table you created in question 2.

Editing Tables

Sometimes the space for the field names is too small.

To **increase the size of the Header section**, do the following:

- Click on the Layout menu and select "Layout."
- Click and drag the lower border of the Header section until all the field names are fully visible.

To **display a table you edited**, click on the Layout menu and select "Browse."

1. Increase the size of the Header section in the table you created, if needed, and see what the table looks like.

To **add an existing field** to a table you created, do the following:

- Click on the Layout menu and select "Layout."
- Click on the Layout menu and select "Insert Field."
- Click the field name you want to insert; then click "Insert."
- Click and drag the field name to where you want it in the Header section.
- Click and drag a handle to make the field name large enough to see all of the name if it is not already fully visible.
- Click and drag the corresponding field value place holder to where you want it in the Body section.

2. Add the Annual Snowfall, cm field to the table you created and see what the table looks like now.

3. Create another table to display only these fields in this order:

   Ski Area Novice Trails, % Intermediate Trails, % Expert Trails, %

   Increase the size of the Header section, if needed, and see what the table looks like.

Saving Changes

In order to be able to return to a database with changes made to it, save the changes on your own disk as your own file, using a file name meaningful to you. However, when starting a blackline master, open the appropriate database from the *MATHPOWER DATA BANK* folder.

To **save changes** to a database, do the following:

- Click on the File menu and select "Save As."
- Type a new name; select the drive and the folder where it is to be saved; and click "Save."

1. Save your changes to the database.

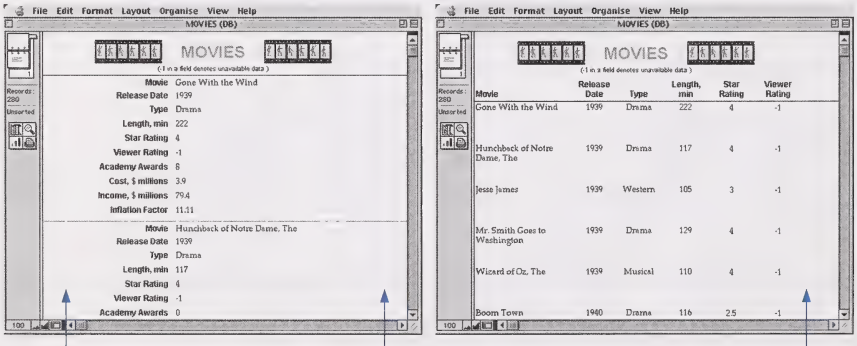
2. Close the database.

Selecting, Hiding, and Copying

Selecting Records

1. Open the Movies database. Display it using Table 1.

To **select a single record**, click outside the fields of the record.


File Edit Format Layout Organise View Help
MOVIES (DB)
MOVIES
(1 in a field denotes unavailable data)
Movie Gone With the Wind
Release Date 1939
Type Drama
Length, min 222
Star Rating 4
Viewer Rating -1
Academy Awards 8
Cost, $ millions 3.9
Income, $ millions 79.4
Inflation Factor 11.11
Movie Hunchback of Notre Dame, The
Release Date 1939
Type Drama
Length, min 117
Star Rating 4
Viewer Rating -1
Academy Awards 0
Movie
Release Date
Type
Length, min
Star Rating
Viewer Rating
Gone With the Wind 1939 Drama 222 4 -1
Hunchback of Notre Dame, The 1939 Drama 117 4 -1
Jesse James 1939 Western 105 3 -1
Mr. Smith Goes to Washington 1939 Drama 129 4 -1
Wizard of Oz, The 1939 Musical 110 4 -1
Boom Town 1940 Drama 116 2.5 -1
Click here.
Or click here.
Click here.

2. Move through the records and select the record of a movie you like.

Near the top left, under the record book, you are told that one record has been selected.

To **deselect a record**, click anywhere on the record while pressing "Command ⌘."

To select **multiple consecutive records**, click outside the fields of the first record and drag through the others.

3. Deselect the record you selected in question 2. Move through the records, select the record of another movie you like and the 4 records that follow it. What does the top left part of the screen, under the record book, tell you now?

To **deselect multiple records**, select any single record (already selected or not) and deselect it.

To **select multiple non-consecutive records**, click outside the fields of one record and click each of the other records while pressing "Command ⌘."

4. Deselect the records you selected in question 3. Move through the records, and select the records of 6 movies you like. What does the top left part of the screen, under the record book, tell you now? Deselect those records.

Hiding Records

To **hide selected records**, click on the Organise menu and select "Hide Selected."

1. Move through the records, select, and then hide the records of 3 movies you are not familiar with.

Near the top left, under the record book, you are told that 277 of 280 records are now displayed and that no records are selected.

To **show all records**, click on the Organise menu and select "Show All Records."

To **hide unselected records**, click on the Organise menu and select "Hide Unselected."

2. Show all the records. Move through them, select the records of 5 movies you like, and then hide the other records. What does the top left part of the screen, under the record book, tell you now?

3. Deselect the records. Then, show all records again.

Copying and Cutting Records

To **copy and paste a record**, do the following:

- Select the record.
- Press "Command ⌘ + C."
- Press "Command ⌘ + V."

The record has been copied and pasted to the end of the database.

1. Move to record 100. What is the movie? Copy and paste the record. Then check to see that it has been pasted at the end of the database. What does the top left part of the screen, under the record book, tell you now?

To **cut a record**, select the record and press "Command ⌘ + X."

2. Cut the record that was pasted at the end of the database. What does the top left part of the screen, under the record book, tell you now?

3. Close the database.

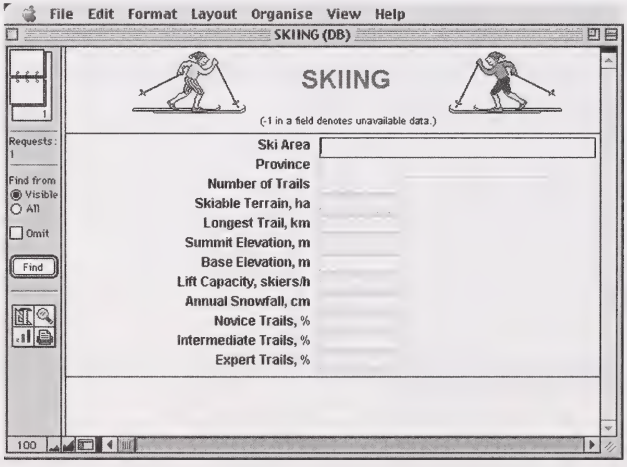
Using the Find Feature

Just as there are times you are interested only in certain fields, there are times you are interested only in certain records. To locate and display only those records, there is a more efficient way than moving through the records, selecting the ones you want, and hiding the others. You can use the Find feature.

1. Open the Skiing database.

To **find records containing one particular value**, do the following:

- Click on the Layout menu and select "Find." The following window appears:



- Click inside the field value box for the field name you want.
- Enter the field value you want.
- In the left margin, select the Visible radial button if not already selected.
- Click "Find."

2. Find all the records for the province of Ontario.

Near the top left, under the record book, you are told that 24 of 116 records are now displayed.

To **show all records**, click on the Organise menu and select "Show All Records."

To **find records with a value greater than, less than, greater than or equal to, less than or equal to a specific value** (for example, 100), do the following:

- Click on the Layout menu and select "Find."
- Click inside the field value box for the field name you want.
- Type the field value > 100 (or < 100 or > = 100 or < = 100).
- In the left margin, select the Visible radial button if not already selected.
- Click "Find."

3. Show all the records. Then, find all the records for lift capacity of 2000 skiers/h or more. How many records are displayed now?

To **find records that contain a particular set of values**, do the following:

- Click on the Layout menu and select "Find."
- Click inside the field value box for the first field name you want.
- Enter the field value you want.
- Click inside the field value box for the next field name you want.
- Enter the field value you want.
- Continue until you have entered all the field values you want.
- In the left margin, select the Visible radial button if not already selected.
- Click "Find."

4. Show all the records. Then, find all the records for the province of Alberta with more than 20 trails and with summit elevations of 2000 m or more. How many records are displayed now?

To **find records that contain one or another of a particular set of values**, do the following:

- Click on the Layout menu and select "Find."
- Click inside the field value box for the first field name you want.
- Enter the field value you want.
- Click on the Edit menu and select "New Request."
- Click inside the field value box for the next field values you want.
- In the left margin, select the Visible radial button if not already selected.
- Click "Find."

5. Show all the records. Then, find all the records for the province of Ontario or Quebec. How many records are displayed now?

When data is not available, -1, -1.0, or -1.00 is shown, depending upon the accuracy to which the field is given. When you are interested in a particular field and the data is not available for some records, usually you would not use those records.

To **find records that exclude a particular value** (such as -1), do the following:

- Click on the Layout menu and select "Find."
- Click inside the field value box for the field name you want.
- Enter the field value "$< > -1$" (excludes -1, -1.0, or -1.00).
- In the left margin, select the Visible radial button if not already selected.
- Click "Find."

6. Show all the records. Then, find all the records for which the percent of expert trails is available; that is, find all the records excluding those with a value of -1 for percent of expert trails. How many records are displayed now?

To **find records that exclude a particular set of values**, use the instructions following question 3, entering "$< > -1$" for each field.

7. Show all the records. Then, find all the records for which summit elevation and base elevation are available. How many records are displayed now?

8. Close the database.

Sorting and Matching

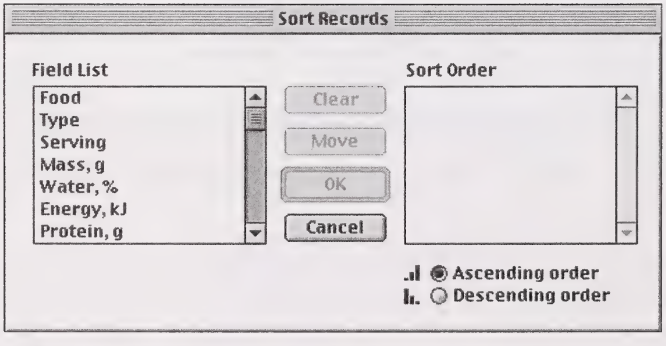
Sorting Records

You can re-order records using the Sort feature.

1. Open the Nutrition database. Display it using Table 2.

To **sort records by ordering one field**, do the following:

- Click on the Organise menu and select "Sort Records." The following window appears:



- Click the field name of the field you want to sort; then click "Move."
- Click the Ascending order radial button for alphabetical or least to greatest, or click the Descending order radial button for greatest to least.
- Click "OK."

2. Sort all the records from greatest to least amount of calcium in a serving. Which food has the greatest amount of calcium in a serving?

Near the top left, under the record book, you are told that the records are now sorted.

To **sort records by ordering more than one field**, do the following:

- Click on the Organise menu and select "Sort Records."
- Clear any previous sorts by highlighting the fields in the Sort Order box and clicking "Clear."
- Click the field name of the first field you want to sort; then click "Move."
- Click the Ascending order or the Descending order radial button.
- Click the field name of the field you want to sort within the first sorted field; then click "Move."
- Click the Ascending order or Descending order radial button.
- Click "OK."

3. Sort all the records alphabetically by type, and, within each type, from greatest to least amount of iron in a serving. What is the first type? Which food in that type has the greatest amount of iron in a serving?

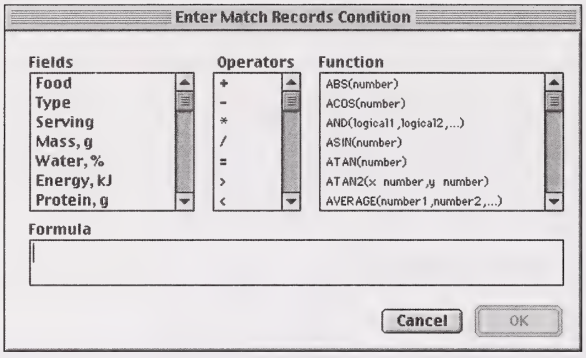
4. Display the records using Table 1. Sort all the records from greatest to least percent of water, and, within that, alphabetically by food. Which food appears first?

Matching Records

Another way of locating particular records involves matching field values. This way is like selecting records in that it highlights the records it located; it is not like finding records, where only the located records are displayed.

To **match records by comparing values in different fields**, do the following:

- Click on the Organise menu and select "Match Records." The following window appears:



- Click the name of one field you want.
- Click the operator you need.
- Click the name of the other field you want.
- Click "OK."

} to create the formula

1. Display the records using Table 2. Select, by matching, all the records where the amount of calcium in a serving is greater than the amount of vitamin C in a serving. Hide the other records. How many records are displayed now?

To **match records where the values of a field, *x*, fall in a range** (such as $100 \le x \le 200$), do the following:

- Click on the Organise menu and select "Match Records."
- Click the Function "AND(logical1,logical2,…)."
- Click and drag through "logical1,logical2,…" in the Formula box.
- Ensuring that the cursor is between the brackets, click the name of the field you want.
- Scroll through the Operators until you see ">="; then click that operator.
- Enter the number and a comma ("100,").
- Click the name of the field again.
- Click on the operator "<=."
- Enter the number "200."
- Click "OK."

2. Show all the records, and deselect the records selected in question 1. Display the records using Table 1. Then, select, by matching, all the records where the energy for a serving is 600 kJ ± 50 kJ (that is, between 550 kJ and 650 kJ inclusive). Hide the other records. How many records are displayed now?

3. Close the database.

Adding Calculation Fields

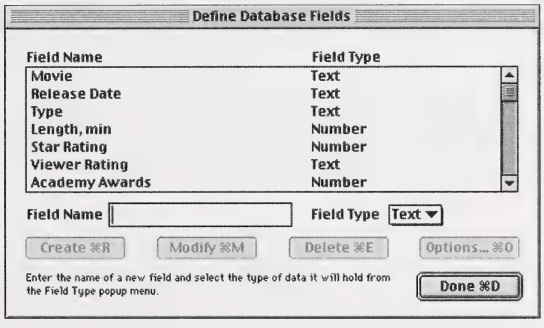
Sometimes you want to add a field, the values for which are calculated using values from existing fields, to records.

1. Open the Movies database. Display it using Table 2.

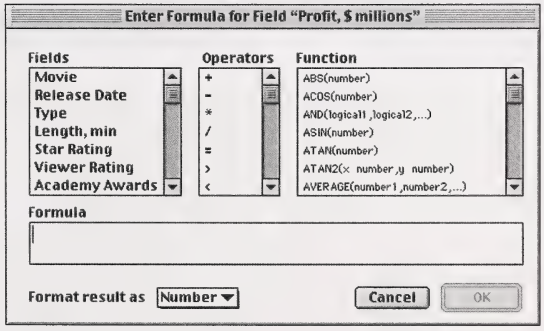
2. Find all the records for which "Income, $ millions" and "Cost, $ millions" are available. (**Hint:** Remove all records with a value of −1 in one or both of these fields.)

To **create a calculation field not requiring rounding**, do the following:

- Click on the Layout menu and select "Define Fields." The following window appears:



- Enter the name you want to call the new field.
- Click ▼ at Field Type and select "Calculation."
- Click "Create." The following window appears:



- Click the field names and operators and enter numbers as needed to create the formula.
- Click "OK."
- Repeat from the second step if you want to create another calculation field.
- Click "Done."

3. Add a calculation field called "Profit, $ millions" using the formula 'Income, $ millions'–'Cost, $ millions'.

Often, the field name is not fully visible, or its placement may not be where you want it.

To **edit a table**, do the following:

- Click on the Layout menu and select "Layout."
- Click and drag the field name to where you want it in the Header section.
- Click and drag a handle to make the field name large enough to see all of the name if it is not already fully visible.
- Click and drag the corresponding field value place holder to where you want it in the Body section.

To **display a table you edited**, click on the Layout menu and select "Browse."

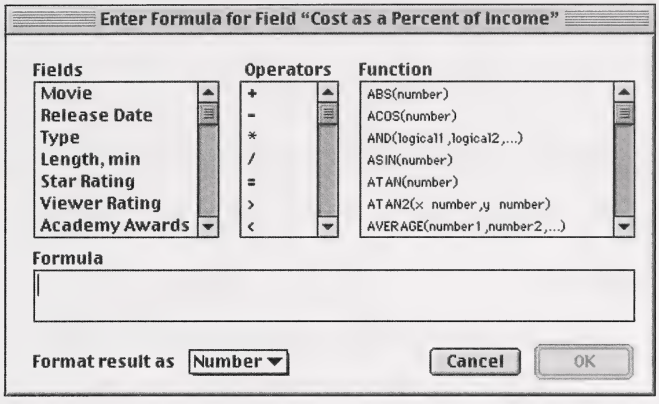
4. Move the field "Profit, $ millions" in your edited table to be in the same line as the other fields in the table, and make sure all the field names are fully visible. See what the table looks like now.

When numbers are multiplied or divided, there is the potential for many decimal places in the result. It is useful to have the answers rounded before they appear in the table. This can be done using the ROUND function.

To **create a calculation field requiring rounding**, do the following:

- Click on the Layout menu and select "Define Fields."
- Enter the name you want to call the new field.
- Click ▼ at Field Type and select "Calculation."

- Click "Create." The following window appears:



- Scroll through the Functions and select "ROUND(number,number of digits).
- Click and drag through "number,number of digits" in the Formula box.
- Ensuring that the cursor is between the brackets, click the field names and operators and enter numbers as needed to create the formula.
- Insert a comma and the number of decimal places to which you want the values rounded.
- Click "OK."
- Repeat from the second step if you want to create another calculation field.
- Click "Done."

Number of digits in the ROUND function means number of digits after the decimal point.

5. Add another calculation field called "Cost as a Percent of Income" using the formula ROUND('Cost, $ millions'/'Income, $ millions'*100,1), which gives the percents rounded to 1 decimal place.

6. How many movies lost money? Explain how you found your answer.

7. Close the database.

Adding Summary Fields

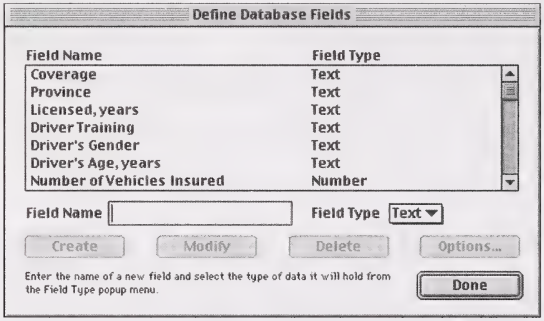
Sometimes you want to summarize data about a number of records.

1. Open the Insurance database. Display it using Table 2.

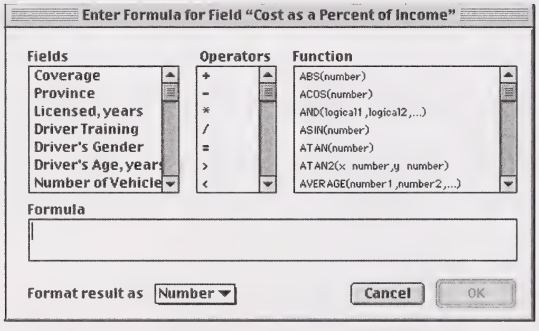
2. Find all the records for collision coverage in Ontario. (See "Using the Find Feature.")

To **create a summary field not requiring rounding** (such as a total), do the following:

- Click on the Layout menu and select "Define Fields." The following window appears:



- Enter the name you want to call the summary field.
- Click ▼ at Field Type and select "Summary."
- Click "Create." The following window appears:



- Scroll through the Functions and select "SUM(number1,number2,...)."
- Click and drag through "number1,number2,..." in the Formula box.
- Ensuring that the cursor is between the brackets, click the name of the field you want to total.
- Click "OK."
- Repeat from the second step if you want to create another summary field.
- Click "Done."

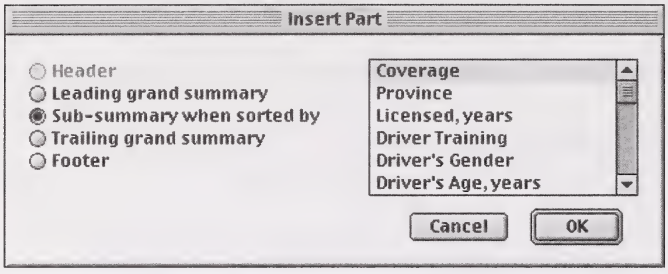
To **create a summary field requiring rounding** (such as finding a mean), do the following:

- Click on the Layout menu and select "Define Fields."
- Enter the name you want to call the summary field.
- Click ▼ at Field Type and select "Summary."
- Click "Create."
- Scroll through the Functions and select "ROUND(number,number of digits)."
- Ensuring that the cursor is between the brackets, click and drag through "number,number of digits" in the Formula box.
- Scroll through the Functions and select "AVERAGE(number1,number2,...)."
- Click and drag through "number1,number2,..." in the Formula box.
- Ensuring that the cursor is between the inner brackets, click the name of the field for which you want to find the mean.
- Insert the cursor after the first closing bracket.
- Insert a comma and the number of decimal places to which you want the value rounded.
- Click "OK."
- Repeat from the second step if you want to create another summary field.
- Click "Done."

As you have seen, tables have a header section and a body section. The first time you create a summary field, you need to create a Trailing Grand Summary section for it. Any subsequent summary fields are placed in the same Trailing Grand Summary section.

To **create a Trailing Grand Summary section**, do the following:

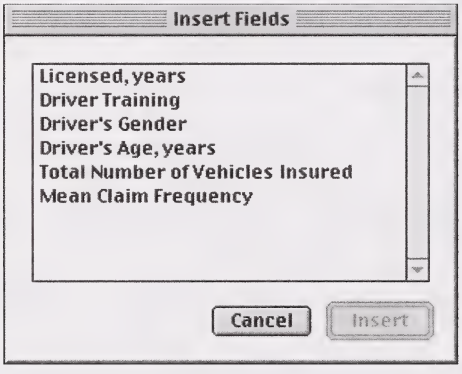
- Click on the Layout menu and select "Layout."
- Click on the Layout menu and select "Insert Part." The following window appears:



- Click the Trailing grand summary radial button.
- Click "OK."

To **insert summary fields in a Trailing Grand Summary section**, do the following:

- Click on the Layout menu and select "Insert Field." The following window appears:



- Click the field names of the summary fields.
- Click "Insert."
- Click and drag the lower border of the Grand Summary section to make that section larger, if needed.
- Click and drag each inserted field name to where you want it in the Grand Summary section.
- Click and drag a handle to make each inserted field name large enough to see all of the name, if it is not already fully visible.

- Click and drag each corresponding field value place holder to where you want it in the Grand Summary section.

Because you created the Trailing Grand Summary section, selecting "Browse" may not display the table with this section.

3. Close the database.

Printing Data

Printing Records

1. Open the Olympics database.

To **print displayed records**, do the following:

- Select or find the records to be printed.
- Click on the Organise menu and select "Hide Unselected," if records are selected and not found.
- Click on the File menu and select "Print."
- Select the All radial button if not already selected. In version 4.0, select the Visible Records radial button if not already selected.
- Click "Print."

2. Find the record for 100-m Freestyle, Women, in 1976.

3. Print that record.

Printing Tables

To **print a table** you created, do the following:

- Display the table to be printed.
- Click on the File menu and select "Print."
- Select the All radial button if not already selected. In version 4.0, select the Visible Records radial button, if not already selected.
- Click "Print."

1. Show all the records. Then, find all the records for Swimming, in 1976.
2. Create a table for those records to display only the following fields:

   Event Winning Athlete Winning Country

   Then, edit your table to make all the field values fully visible.
3. Print the table.
4. Close the database.

Making and Printing Graphs

Graphing Data

Sometimes specific records in tables showing only specific fields can be even more useful when graphed.

1. Open the Nutrition database.
2. Find all the records for soup.

To **graph data from a database**, do the following:

- Create a table showing the records and the fields you want.
- Copy those records.
- Click on the File menu and select "New"; then select "Spreadsheet" and click "OK" to open a new spreadsheet.
- Paste the records starting on the second row of the spreadsheet.
- Adjust the widths of the cells so that the field values are fully visible.
- Delete extra words in each cell to make the wording more concise for use as a graph label, if necessary.
- Enter the headings in the first row to complete the table.
- Select the cells containing the complete table.
- Click on the Options menu and select "Make Chart."
- Choose the type of graph and other options you want.

- Modify as needed.
- Click and drag a handle to make the graph the size you want.
- Click and drag the graph to position it below the cells containing the table.

3. Create a table for those records to display only these fields in this order:

   Food Iron, mg

   Then, edit the table so that the entries are fully visible.

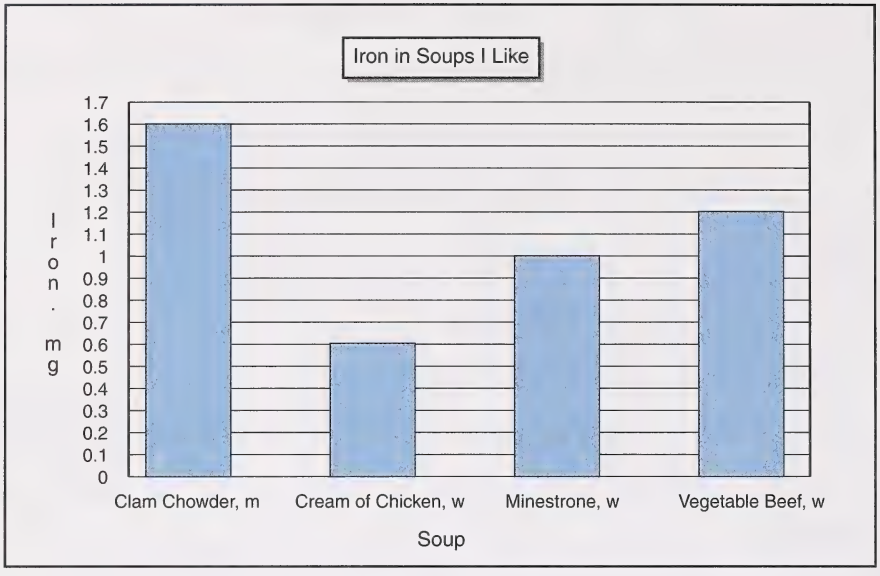
4. Select the records of 4 types of soups that you like and hide the others.

5. Copy and paste the data to a spreadsheet. Then, graph iron on the *y*-axis and food on the *x*-axis.

Printing Graphs

To **print a graph**, do the following:

- With the graph positioned below the cells containing the table, click a row number above the graph, but below the table, highlighting the entire row.
- Click on the Options menu and select "Add Page Break."
- Click on the File menu and select "Page Setup."
- Select an orientation, depending upon the size and shape of your graph.
- Click "OK."
- Click on the File menu and select "Print."
- Click on the radial button in front of the From box.
- Type "2" in the From box.
- Type "2" in the To box.
- In version 4.0, deselect "Print Column Headings," "Print Row Headings," and "Print Cell Grids" to prevent the background from being printed.
- Click "Print."



To **print the cells containing a table**, use the same steps as listed previously but print from page 1 to page 1.

To **print both the cells containing a table and a graph**, use the same steps as listed previously but select the All radial button and eliminate adding a page break if desired.

6. Print your graph.

7. Close your spreadsheet and the database.

Computer Data Bank for Windows

System and Software Requirements

To use the *ClarisWorks*™ for Windows databases in *MATHPOWER*™ *10, Western Edition, Computer Data Bank*, you need

- an IBM-PC or equivalent with at least an 80386/DX microprocessor
- hard disk drive and at least 8 MB of RAM
- a 3.5-inch high-density floppy disk drive
- VGA or better video
- mouse or compatible pointing device
- Windows 95 or higher installed on your hard drive
- *ClarisWorks*™ 4.0 or higher installed on your hard drive
- Times New Roman, Arial, and Symbol (which come packaged with Windows) installed on your hard drive

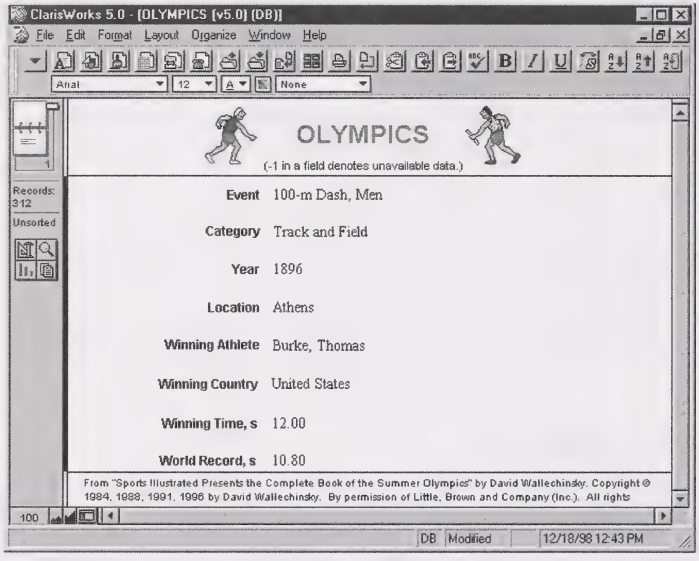
Database Basics

What Is a Database?

1. Open the Olympics database from the mp-cw-db folder.

To **maximize a window**, click the maximize button near the right end of the window's title bar.

2. Maximize the window.


ClarisWorks 5.0 - [OLYMPICS (v5.0) (DB)]
File Edit Format Layout Organize Window Help
Arial 12 None
OLYMPICS
(-1 in a field denotes unavailable data.)
Records: 312
Unsorted
Event 100-m Dash, Men
Category Track and Field
Year 1896
Location Athens
Winning Athlete Burke, Thomas
Winning Country United States
Winning Time, s 12.00
World Record, s 10.80
From "Sports Illustrated Presents the Complete Book of the Summer Olympics" by David Wallechinsky. Copyright © 1984, 1988, 1991, 1996 by David Wallechinsky. By permission of Little, Brown and Company (Inc.). All rights
100
DB Modified 12/18/98 12:43 PM

A **database** is a collection of related information that you can reorganize in order to interpret and analyse the information.

A database consists of sets of **records**. Each record is a set of **fields**. The **field names** are on the left and the **field values** are to the right. The first record is about the 100-m dash for men, in 1896, in Athens. The first field name in each record is "Event." The last field name in each record is "World Record, s." There are 8 fields in all.

3. What are the other 6 field names?

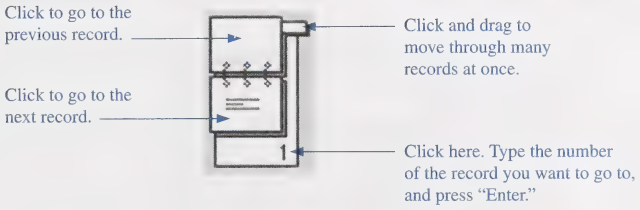
The Event field value is "100-m Dash, Men" in the first record.

4. What is the field value of the Winning Time, s field in the first record?

Moving Through Records

There are many ways to **move through records**, including

- pressing "Page Down" or "Page Up" keys
- using the scroll bar on the right
- using the record book on the left near the top


Click to go to the previous record.
Click to go to the next record.
Click and drag to move through many records at once.
1
Click here. Type the number of the record you want to go to, and press "Enter."

Just below the record book, you are told that there are 312 records in this database and they are unsorted.

1. Move to record 145. What is it about?

2. Move to the record just before record 145. What is it about?

3. What is the last record in this database about?

4. Move back to the first record.

Ways to Display Records

The databases have been set up to display full records, one after the other (as you have been looking at them), and in tables with the field names as headers and the field values in columns below the headers.

1. Click on the Layout menu and observe the ✓ in front of "Full Record."

The ✓ tells you that Full Record is being displayed. Below Full Record are "Table 1" and "Table 2." More than one table is needed to show all the fields. You can also create your own tables. You will do this later.

To **change how the records are displayed**, click on the Layout menu and select "Full Record," "Table 1," or "Table 2" (or an alternative when it has been created).

2. Display the records all three ways. When might you use each way?

3. Close the database.

Creating Tables and Saving Changes

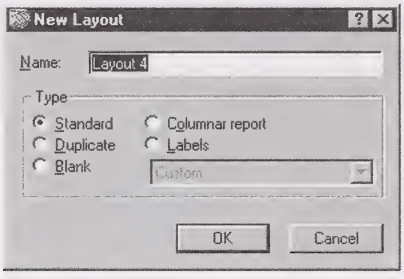
Creating Tables

Sometimes you are interested only in certain fields. You can create a table to display only those fields.

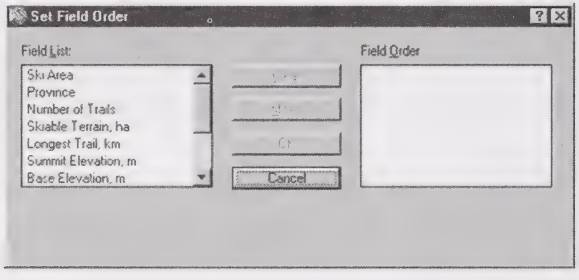
1. Open the Skiing database. Are the records in full-record layout or in a table layout?

To **create a table** that will display only certain fields from existing records, do the following:

- Click on the Layout menu and select "New Layout." The following window appears:



- Enter a name or use the one given; click on the Columnar report radial button; and click "OK." The following window appears:



- Click the field name you want first in the table; then click "Move."
- Click the field name you want second; then click "Move."
- Continue until you have all the field names you want moved; then click "OK."

2. Create a table to display only these fields in this order:

Ski Area Number of Trails Longest Trail, km

Sometimes a field value is not fully visible.

To **see all of a field value**, click on the field value.

3. Click to see the full name of the second ski area. What is it?

To **change how the records are displayed**, click on the Layout menu and select "Full Record," "Table 1," or "Table 2" (or an alternative when it has been created).

4. Display the records using Full Record. Then, display them using the table you created in question 2.

Editing Tables

Sometimes the space for the field names is too small.

To **increase the size of the Header section**, do the following:

- Click on the Layout menu and select "Layout."
- Click and drag the lower border of the Header section until all the field names are fully visible.

To **display a table you edited**, click on the Layout menu and select "Browse."

1. Increase the size of the Header section in the table you created, if needed, and see what the table looks like.

To **add an existing field** to a table you created, do the following:

- Click on the Layout menu and select "Layout."
- Click on the Layout menu and select "Insert Field."
- Click the field name you want to insert; then click "Insert."
- Click and drag the field name to where you want it in the Header section.
- Click and drag a handle to make the field name large enough to see all of the name if it is not already fully visible.
- Click and drag the corresponding field value place holder to where you want it in the Body section.

2. Add the Annual Snowfall, cm field to the table you created and see what the table looks like now.

3. Create another table to display only these fields in this order:

Ski Area Novice Trails, % Intermediate Trails, % Expert Trails, %

Increase the size of the Header section, if needed, and see what the table looks like.

Saving Changes

In order to be able to return to a database with changes made to it, save the changes on your own disk as your own file, using a file name meaningful to you. However, when starting a blackline master, open the appropriate database from the mp-cw-db folder.

To **save changes** to a database, do the following:

- Click on the File menu and select "Save As."
- Type a new name; select the drive and the directory where it is to be saved; and click "Save."

1. Save your changes to the database.

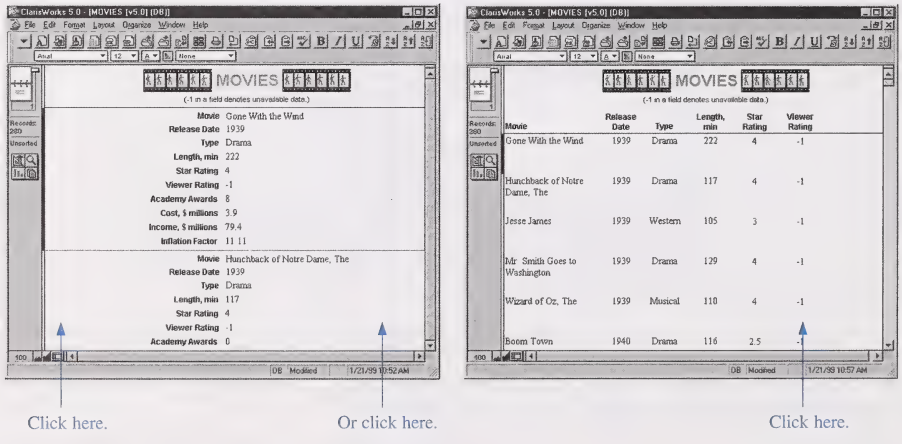
2. Close the database.

Manipulating Records

Selecting Records

1. Open the Movies database. Display it using Table 1.

To **select a single record**, click outside the fields of the record.



2. Move through the records and select the record of a movie you like.

Near the top left, under the record book, you are told that one record has been selected.

To **deselect a record**, click anywhere on the record while pressing "Ctrl."

To select **multiple consecutive records**, click outside the fields of the first record and drag through the others.

3. Deselect the record you selected in question 2. Move through the records, select the record of another movie you like and the 4 records that follow it. What does the top left part of the screen, under the record book, tell you now?

To **deselect multiple records**, select any single record (already selected or not) and deselect it.

To **select multiple non-consecutive records**, click outside the fields of one record and click each of the other records while pressing "Ctrl."

4. Deselect the records you selected in question 3. Move through the records, and select the records of 6 movies you like. What does the top left part of the screen, under the record book, tell you now? Deselect those records.

Hiding Records

To **hide selected records**, click on the Organise menu and select "Hide Selected."

1. Move through the records, select, and then hide the records of 3 movies you are not familiar with.

Near the top left, under the record book, you are told that 277 of 280 records are now displayed and that no records are selected.

To **show all records**, click on the Organise menu and select "Show All Records."

To **hide unselected records**, click on the Organise menu and select "Hide Unselected."

2. Show all the records. Move through them, select the records of 5 movies you like, and then hide the other records. What does the top left part of the screen, under the record book, tell you now?

3. Deselect the records. Then, show all records again.

Copying and Cutting Records

To **copy and paste a record**, do the following:

- Select the record.
- Press "Ctrl + C."
- Press "Ctrl + V."

The record has been copied and pasted to the end of the database.

1. Move to record 100. What is the movie? Copy and paste the record. Then, check to see that it has been pasted at the end of the database. What does the top left part of the screen, under the record book, tell you now?

To **cut a record**, select the record and press "Ctrl + X."

2. Cut the record that was pasted at the end of the database. What does the top left part of the screen, under the record book, tell you now?

3. Close the database.

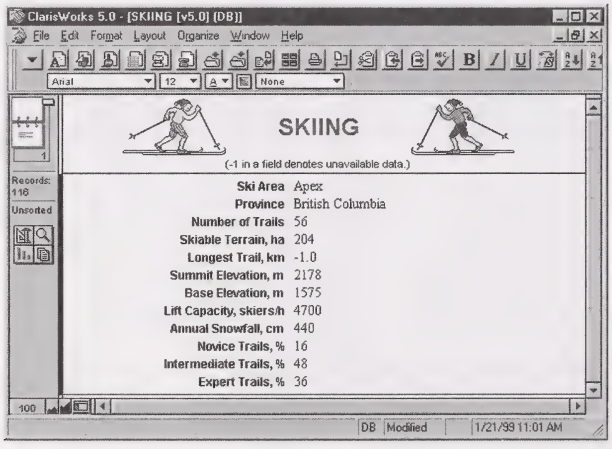
Finding Records

Just as there are times you are interested only in certain fields, there are times you are interested only in certain records. To locate and display only those records, there is a more efficient way than moving through the records, selecting the ones you want, and hiding the others. You can use the Find feature.

1. Open the Skiing database.

To **find records containing one particular value**, do the following:

- Click on the Layout menu and select "Find." The following window appears:



- Click inside the field value box for the field name you want.
- Enter the field value you want.
- In the left margin, select the Visible radial button if not already selected.
- Click "Find."

2. Find all the records for the province of Ontario.

Near the top left, under the record book, you are told that 24 of 116 records are now displayed.

To **show all records**, click on the Organise menu and select "Show All Records."

To **find records with a value greater than, less than, greater than or equal to, less than or equal to a specific value** (for example, 100), do the following:

- Click on the Layout menu and select "Find."
- Click inside the field value box for the field name you want.
- Type the field value > 100 (or < 100 or > = 100 or < = 100).
- In the left margin, select the Visible radial button if not already selected.
- Click "Find."

3. Show all the records. Then, find all the records for lift capacity of 2000 skiers/h or more. How many records are displayed now?

To **find records that contain a particular set of values**, do the following:

- Click on the Layout menu and select "Find."
- Click inside the field value box for the first field name you want.
- Enter the field value you want.
- Click inside the field value box for the next field name you want.
- Enter the field value you want.
- Continue until you have entered all the field values you want.
- In the left margin, select the Visible radial button if not already selected.
- Click "Find."

4. Show all the records. Then, find all the records for the province of Alberta with more than 20 trails and with summit elevations of 2000 m or more. How many records are displayed now?

To **find records that contain one or another of a particular set of values**, do the following:

- Click on the Layout menu and select "Find."
- Click inside the field value box for the first field name you want.
- Enter the field value you want.
- Click on the Edit menu and select "New Request."
- Click inside the field value box for the next field name you want.
- Enter the field value you want.
- Continue until you have entered all the field values you want.
- In the left margin, select the Visible radial button if not already selected.
- Click "Find."

5. Show all the records. Then, find all the records for the province of Ontario or Quebec. How many records are displayed now?

When data is not available, -1, -1.0, or -1.00 is shown, depending upon the accuracy to which the field is given. When you are interested in a particular field and the data is not available for some records, usually you would not use those records.

To **find records that exclude a particular value** (such as -1), do the following:

- Click on the Layout menu and select "Find."
- Click inside the field value box for the field name you want.
- Enter the field value "< > -1" (excludes -1, -1.0, or -1.00).
- In the left margin, select the Visible radial button if not already selected.
- Click "Find."

6. Show all the records. Then, find all the records for which the percent of expert trails is available; that is, find all the records excluding those with a value of -1 for percent of expert trails. How many records are displayed now?

To **find records that exclude a particular set of values**, use the To find instructions following question 3, entering "< > -1" for each field.

7. Show all the records. Then, find all the records for which summit elevation and base elevation are available. How many records are displayed now?

8. Close the database.

Organizing Records

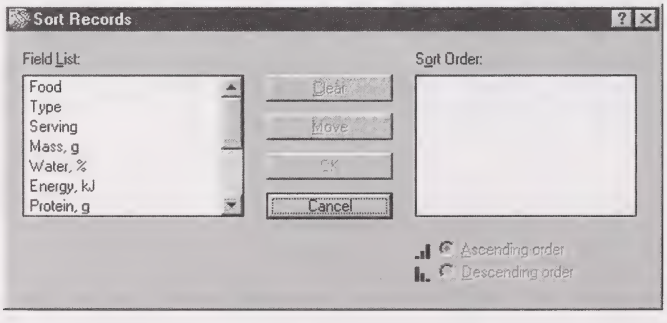
Sorting Records

You can re-order records using the Sort feature.

1. Open the Nutrition database. Display it using Table 2.

To **sort records by ordering one field**, do the following:

- Click on the Organise menu and select "Sort Records." The following window appears:



- Click the field name of the field you want to sort; then click "Move."
- Click the Ascending order radial button for alphabetical or least to greatest, or click the Descending order radial button for greatest to least.
- Click "OK."

2. Sort all the records from greatest to least amount of calcium in a serving. Which food has the greatest amount of calcium in a serving?

Near the top left, under the record book, you are told that the records are now sorted.

To **sort records by ordering more than one field**, do the following:

- Click on the Organise menu and select "Sort Records."
- Clear any previous sorts by highlighting the fields in the Sort Order box and clicking "Clear."
- Click the field name of the first field you want to sort; then click "Move."
- Click the Ascending order or the Descending order radial button.
- Click the field name of the field you want to sort within the first sorted field; then click "Move."
- Click the Ascending order or Descending order radial button.
- Click "OK."

3. Sort all the records alphabetically by type, and, within each type, from greatest to least amount of iron in a serving. What is the first type? Which food in that type has the greatest amount of iron in a serving?

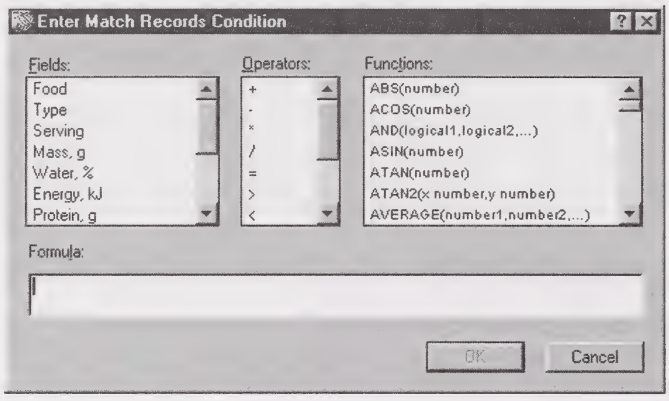
4. Display the records using Table 1. Sort all the records from greatest to least percent of water, and, within that, alphabetically by food. Which food appears first?

Matching Records

Another way of locating particular records involves matching field values. This way is like selecting records in that it highlights the records it located; it is not like finding records, where only the located records are displayed.

To **match records by comparing values in different fields**, do the following:

- Click on the Organise menu and select "Match Records." The following window appears:



- Click the name of one field you want.
- Click the operator you need.
- Click the name of the other field you want.
- Click "OK."

} to create the formula

1. Display the records using Table 2. Select, by matching, all the records where the amount of calcium in a serving is greater than the amount of vitamin C in a serving. Hide the other records. How many records are displayed now?

To **match records where the values of a field, *x*, fall in a range** (such as $100 \leq x \leq 200$), do the following:

- Click on the Organise menu and select "Match Records."
- Click the Function "AND(logical1,logical2,…)."
- Click and drag through "logical1,logical2,…" in the Formula box.
- Ensuring that the cursor is between the brackets, click the name of the field you want.
- Scroll through the Operators until you see ">="; then click that operator.
- Enter the number and a comma ("100,").
- Click the name of the field again.
- Click on the operator "<=."
- Enter the number "200."
- Click "OK."

2. Show all the records, and deselect the records selected in question 1. Display the records using Table 1. Then, select, by matching, all the records where the energy for a serving is 600 kJ ± 50 kJ (that is, between 550 kJ and 650 kJ inclusive). Hide the other records. How many records are displayed now?

3. Close the database.

Creating Calculation Fields

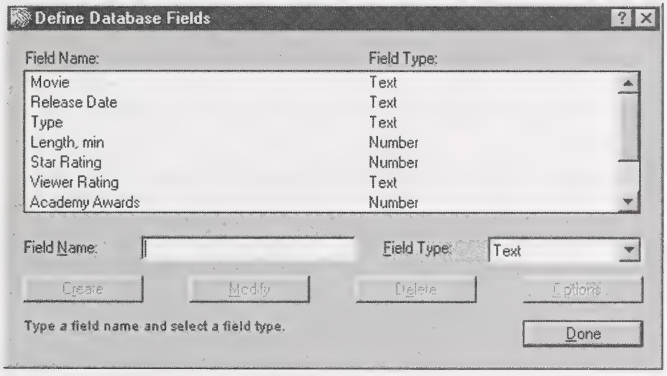
Sometimes you want to add a field, the values for which are calculated using values from existing fields, to records.

1. Open the Movies database. Display it using Table 2.

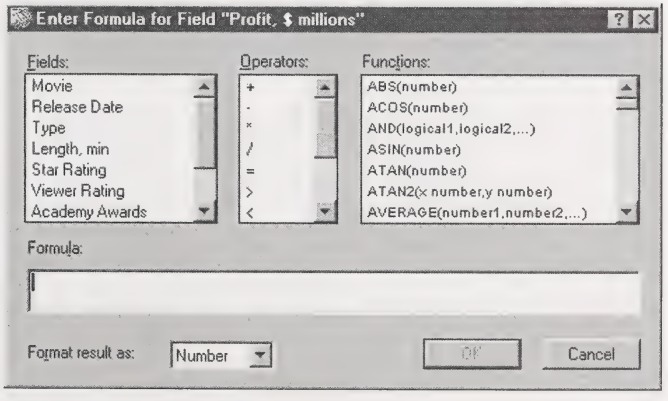
2. Find all the records for which "Income, $ millions" and "Cost, $ millions" are available. **Hint:** Remove all records with a −1 in one or both of these fields.

To **create a calculation field not requiring rounding**, do the following:

- Click on the Layout menu and select "Define Fields." The following window appears:



- Enter the name you want to call the new field.
- Click ▼ at Field Type and select "Calculation."
- Click "Create." The following window appears:



- Click the field names and operators and enter numbers as needed to create the formula.
- Click "OK."
- Repeat from the second step if you want to create another calculation field.
- Click "Done."

3. Add a calculation field called "Profit, $ millions" using the formula 'Income, $ millions'–'Cost, $ millions'.

Often, the field name is not fully visible, or its placement may not be where you want it.

To **edit a table**, do the following:

- Click on the Layout menu and select "Layout."
- Click and drag the field name to where you want it in the Header section.
- Click and drag a handle to make the field name large enough to see all of the name if it is not already fully visible.
- Click and drag the corresponding field value place holder to where you want it in the Body section.

To **display a table you edited**, click on the Layout menu and select "Browse."

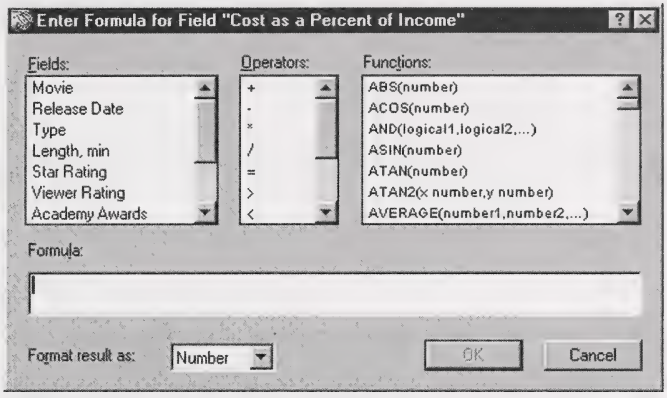
4. Move the field "Profit, $ millions" in your edited table to be in the same line as the other fields in the table, and make sure all the field names are fully visible. See what the table looks like now.

When numbers are multiplied or divided, there is the potential for many decimal places in the result. It is useful to have the answers rounded before they appear in the table. This can be done using the ROUND function.

To **create a calculation field requiring rounding**, do the following:

- Click on the Layout menu and select "Define Fields."
- Enter the name you want to call the new field.
- Click ▼ at Field Type and select "Calculation."

- Click "Create." The following window appears:



- Scroll through the Functions and select "ROUND(number,number of digits).
- Click and drag through "number,number of digits" inside the brackets in the Formula box.
- Ensuring that the cursor is between the brackets, click the field names and operators and type numbers as needed to create the formula.
- Insert a comma and the number of decimal places to which you want the values rounded.
- Click "OK."
- Repeat from the second step if you want to create another calculation field.
- Click "Done."

Number of digits in the ROUND function means number of digits after the decimal point.

5. Add another calculation field called "Cost as a Percent of Income" using the formula ROUND('Cost, $ millions'/'Income, $ millions'*100,1), which gives the percents rounded to 1 decimal place.

6. How many movies lost money? Explain how you found your answer.

7. Close the database.

Creating Summary Fields

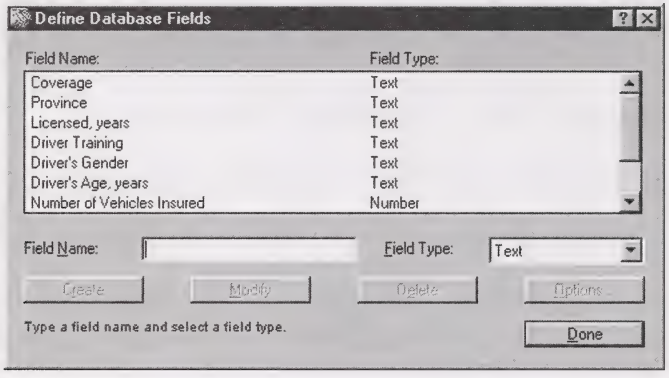
Sometimes you want to summarize data about a number of records.

1. Open the Insurance database. Display it using Table 2.

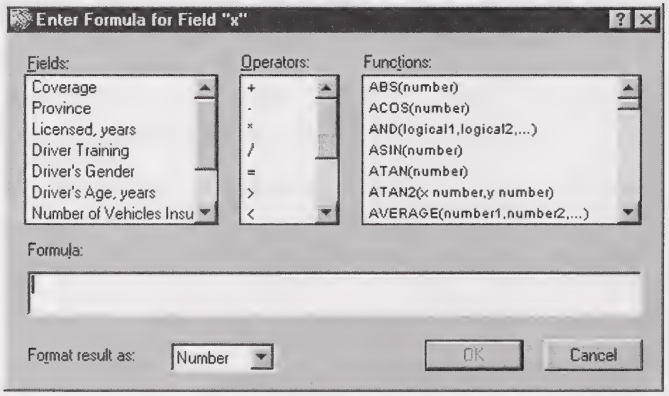
2. Find all the records for collision coverage in Ontario. (See "Using the Find Feature.")

To **create a summary field not requiring rounding** (such as a total), do the following:

- Click on the Layout menu and select "Define Fields." The following window appears:



- Enter the name you want to call the summary field.
- Click ▼ at Field Type and select "Summary."
- Click "Create." The following window appears:



- Scroll through the Functions and select "SUM(number1,number2,...)."
- Click and drag through "number1,number2,..." in the Formula box.
- Ensuring that the cursor is between the brackets, click the name of the field you want to total.
- Click "OK."
- Repeat from the second step if you want to create another summary field.
- Click "Done."

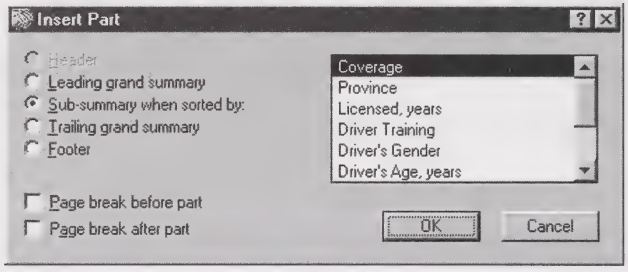
To **create a summary field requiring rounding** (such as finding a mean), do the following:

- Click on the Layout menu and select "Define Fields."
- Enter the name you want to call the summary field.
- Click [▼] at Field Type and select "Summary."
- Click "Create."
- Scroll through the Functions and select "ROUND(number,number of digits)."
- Ensure that the cursor is between the brackets, click and drag through "number,number of digits" in the Formula box.
- Scroll through the Functions and select "AVERAGE(number1,number2,...)."
- Click and drag through "number1,number2,..." in the Formula box.
- Ensuring that the cursor is between the inner brackets, click the name of the field for which you want to find the mean.
- Insert the cursor after the first closing bracket.
- Insert a comma and the number of decimal places to which you want the value rounded.
- Click "OK."
- Repeat from the second step if you want to create another summary field.
- Click "Done."

As you have seen, tables have a header section and a body section. The first time you create a summary field, you need to create a Trailing Grand Summary section for it. Any subsequent summary fields are placed in the same Trailing Grand Summary section.

To **create a Trailing Grand Summary section**, do the following:

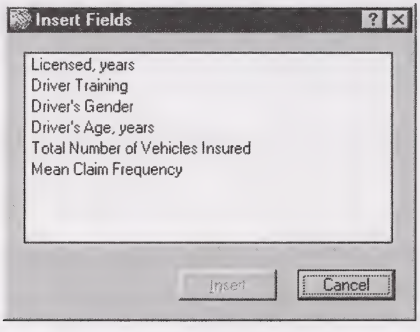
- Click on the Layout menu and select "Layout."
- Click on the Layout menu and select "Insert Part." The following window appears:



- Click the Trailing grand summary radial button.
- Click "OK."

To **insert summary fields in a Trailing Grand Summary section**, do the following:

- Click on the Layout menu and select "Insert Field." The following window appears:



- Click the field names of the summary fields.
- Click "Insert."
- Click and drag the lower border of the Grand Summary section to make that section larger, if needed.
- Click and drag each inserted field name to where you want it in the Grand Summary section.
- Click and drag a handle to make each inserted field name large enough to see all of the name, if it is not already fully visible.

- Click and drag each corresponding field value place holder to where you want it in the Grand Summary section.

Because you created the Trailing Grand Summary section, selecting "Browse" may not display the table with this section.

3. Close the database.

Printing Records and Tables

Printing Records

1. Open the Olympics database.

To **print displayed records**, do the following:

- Select or find the records to be printed.
- Click on the Organise menu and select "Hide Unselected," if records are selected and not found.
- Click on the File menu and select "Print."
- Select the All radial button in the Print Range box if not already selected.
- Select the Visible Records radial button in the Print Records box if not already selected.
- Click "OK."

2. Find the record for 100-m Freestyle, Women, in 1976.

3. Print that record.

Printing Tables

To **print a table** you created, do the following:

- Display the table to be printed.
- Click on the File menu and select "Print."
- Select the All radial button in the Print Range box if not already selected.
- Select the Visible Records radial button in the Print Records box if not already selected.
- Click "OK."

1. Show all the records. Then, find all the records for Swimming, in 1976.

2. Create a table for those records to display only the following fields:

   Event Winning Athlete Winning Country

   Then, edit your table to make all the field values fully visible.

3. Print the table.

4. Close the database.

Graphing Data and Printing Graphs

Graphing Data

Sometimes specific records in tables showing only specific fields can be even more useful when graphed.

1. Open the Nutrition database.

2. Find all the records for soup.

To **graph data from a database**, do the following:

- Create a table showing the records and the fields you want.
- Copy those records.
- Click on the File menu and select "New"; then select "Spreadsheet" and click "OK" to open a new spreadsheet.
- Paste the records starting on the second row of the spreadsheet.
- Adjust the widths of the cells so that the field values are fully visible.
- Delete extra words in each cell to make the wording more concise for use as a graph label, if necessary.
- Enter the headings in the first row to complete the table.
- Select the cells containing the complete table.
- Click on the Options menu and select "Make Chart."
- Choose the type of graph and other options you want.
- Modify as needed.

- Click and drag a handle to make the graph the size you want.
- Click and drag the graph to position it below the cells containing the table.

3. Create a table for those records to display only these fields in this order:

   Food Iron, mg

   Then, edit the table so that the entries are fully visible.

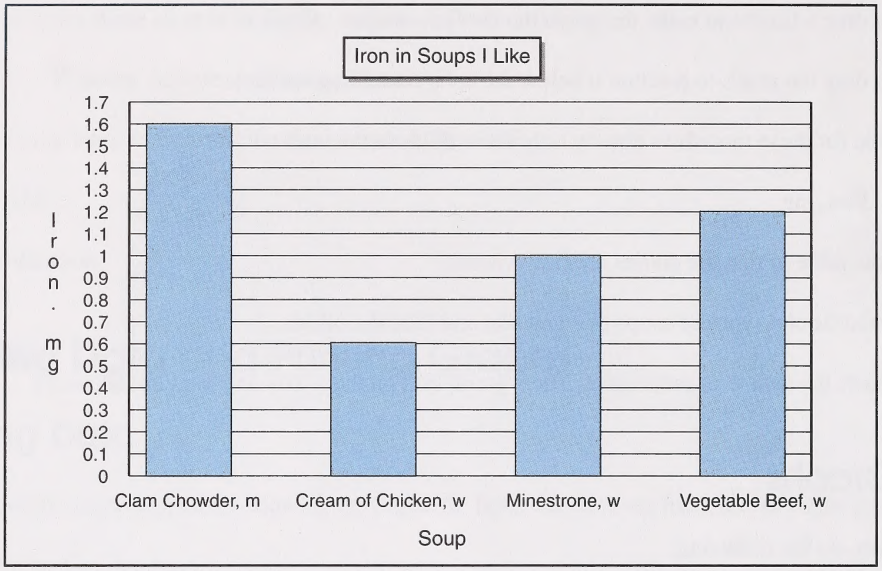
4. Select the records of 4 types of soups that you like and hide the others.

5. Copy and paste the data to a spreadsheet. Then, graph iron on the *y*-axis and food on the *x*-axis.

Printing Graphs

To **print a graph**, do the following:

- With the graph positioned below the cells containing the table, click a row number above the graph, but below the table, highlighting the entire row.
- Click on the Options menu and select "Add Page Break."
- Click on the File menu and select "Print Setup."
- Select on orientation, depending upon the size and shape of your graph.
- Click "OK."
- Click on the File menu and select "Print."
- Select the Pages radial button in the Print Range box.
- Type "2" in the From box.
- Press Tab.
- Type "2" in the To box.
- Deselect "Print Column Headings," "Print Row Headings," and "Print Cell Grids" to prevent the background from being printed.
- Click "OK."



To **print the cells containing a table**, use the same steps as listed previously but print from page 1 to page 1.

To **print both the cells containing a table and a graph**, use the same steps as listed previously but print from pages 1 to 2.

6. Print your graph.

7. Close your spreadsheet and the database.

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